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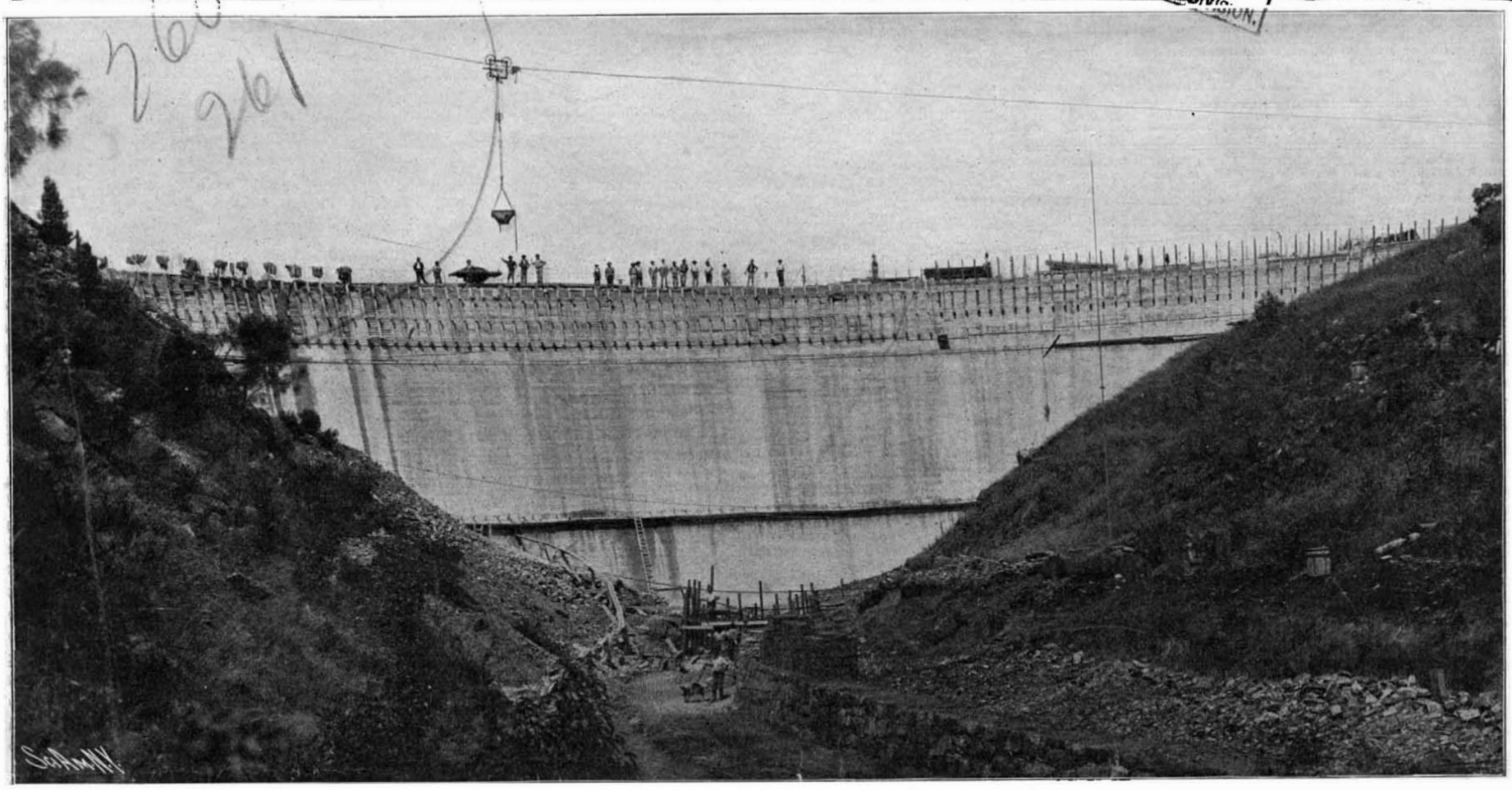
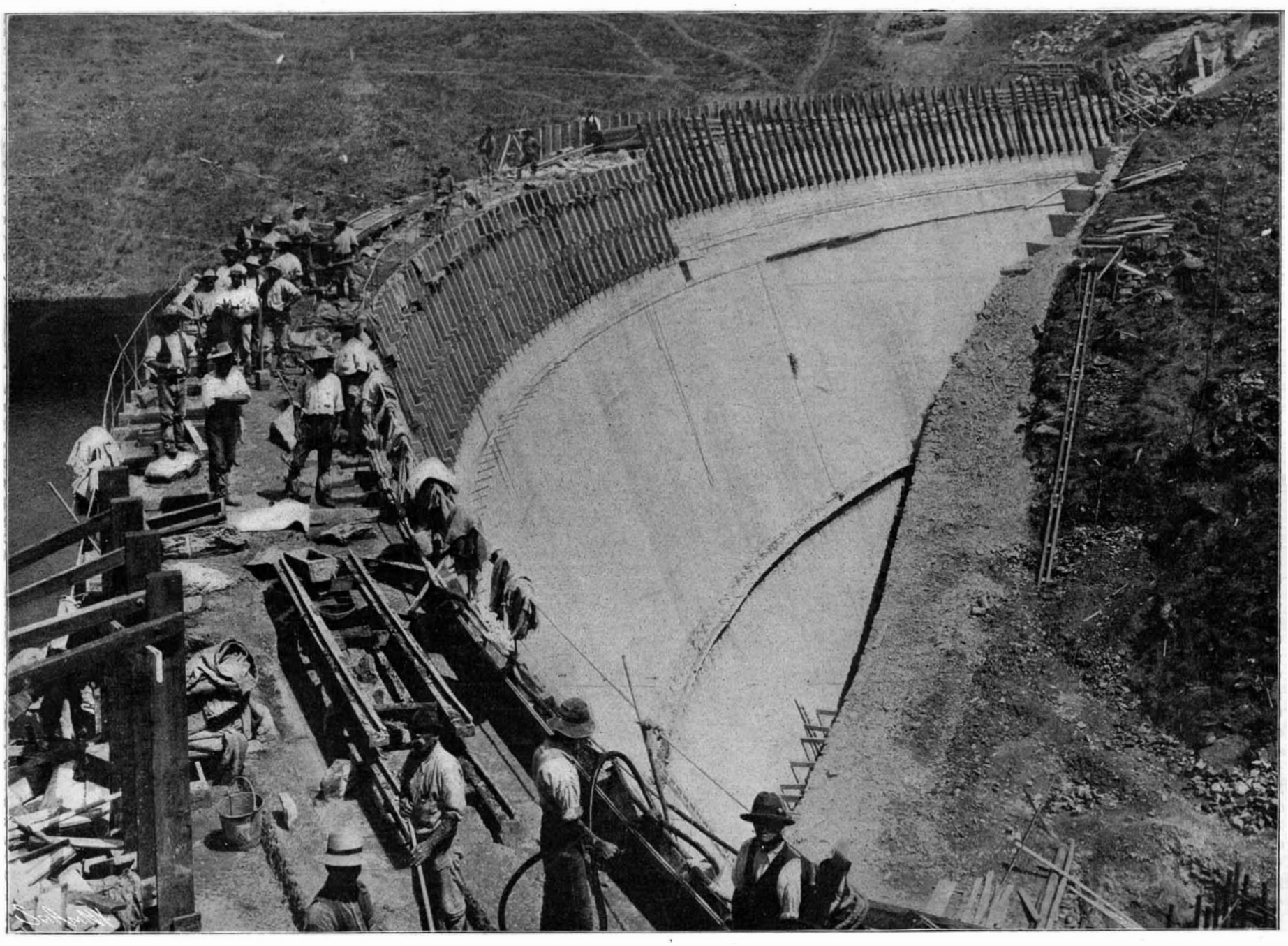
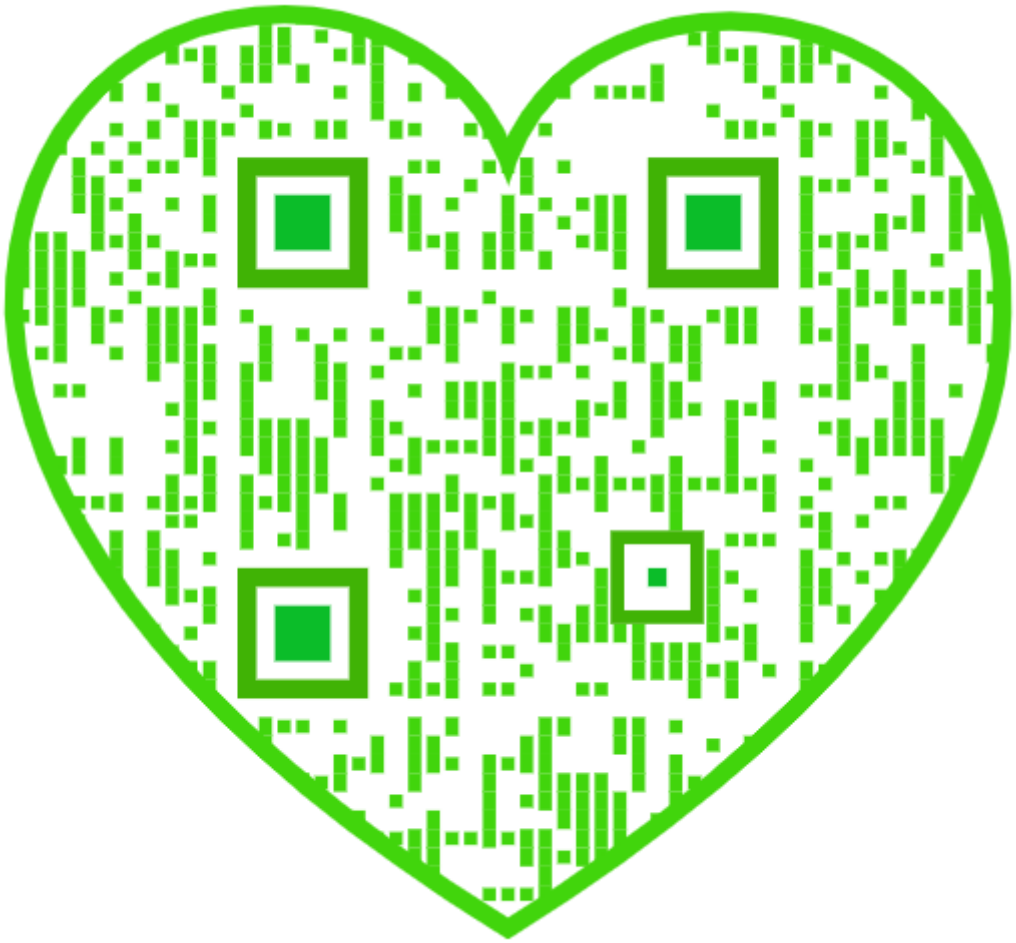


View of the Dam From Down Stream.



The Dam in Course of Construction.

THE CURVED CONCRETE DAM AT BAROSSA, AUSTRALIA.—[See page 266.]



SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, APRIL 1, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

CASUALTIES—MILITARY AND CIVIL.

And now it would seem that the steam railroad has a close rival in the art of killing and wounding; for the latest statistics of the Census Bureau show that during a single year 1,218 persons were killed and 47,429 injured by street railway lines in this country. To those of us who happen to live in New York, where just now the daily collision on our elevated and subway lines, with its list of casualties, is an item that we should miss from our morning paper, these figures may not prove so startling as to the citizen who travels under more normal conditions; but in all conscience they are big enough to be positively shocking, particularly when we remember that a great number of street car accidents are never reported. Added to the statistics of steam railroad accidents, they show that people are being killed at the rate of 5,300 and wounded at the rate of 100,000 a year! And it all happens to persons who are engaged in the "peaceful pursuits" of "the most highly-developed civilization" of modern times.

Add together two or three years of such statistics, and you get a total casualty list equaling that of the Russo-Japanese war.

Odd, is it not, that we should blench with horror, as we read in one column of the wholesale killing and wounding on Manchurian battlefields of men whose profession it is to kill and be killed, and yet read in the next column with easy composure of the day-by-day killing and wounding of our neighbors or associates, under circumstances for which in nine cases out of ten there is no excuse whatever to be offered.

"CONSIGNED TO THE SCRAP HEAP."

The New York Evening Post has delivered itself of the following: "What the big-navy men cannot deny is that a single new invention or development in marine engineering may consign our enormously costly fleet to the scrap heap without a moment's warning." Strange, is it not, that our staid contemporary should commit itself in its most approved *ex cathedra* manner to what is surely one of the most foolish fallacies of the day. And still more strange that it should do so at a time when the naval experts are telling us all that, if the naval operations of the present war teach one truth more than any other, it is that the battleship is the supreme engine of naval warfare—more secure to-day than ever against the many cheap and short-cut devices that were designed to bring about its "annihilation." It was but a few days ago that the captain of one of the sunken ships at Port Arthur assured the writer that the battleship had more than vindicated its construction, and the principles and theories upon which it had been designed. His own ship, struck time and again by mines, battered by direct shell fire from Togo's battleships, and by the plunging shells from Nogi's batteries, the target for at least a score of torpedoes, some of which found the mark, was sent to the bottom only when he himself opened the sea valves to prevent her from becoming the prize of the enemy. In all the rough handling, above water and below, that the Russian fleet has received in the past twelve months, it was the battleship alone that time and again proved able to survive the blow of the torpedo or the floating mine. For a cruiser to be struck by one of these deadly weapons has meant, with a single exception, immediate and total destruction. Not a battleship was sunk by gun fire; whereas cruisers, and all smaller craft, were by this means sunk or so badly damaged as to be put out of action. It is the battleship that has decided the issue of the naval campaign. In the coming fight, down in the Indian Ocean, between Rojestvensky and Togo, the fate of the victorious Manchurian armies of Japan will depend upon what number of battleships survive on either side. If the unexpected should happen, and Togo should lose three or four of his battleships, not all the armored cruisers, protected cruisers, gunboats, and torpedo boats of Japan could wrest from Russia the command of the sea, or stave off the ultimate capitulation of Oyama's armies.

The history of modern naval development shows that it has moved steadily in the direction of big units, each representing a vast concentration of fighting power, whether for attack or defense. Our 16,000-ton "Connecticuts" and "Louisianas" are the result of a law of evolution, which is as inexorable in a warship as it is in the processes of natural life. At the same time, naval history shows that inventors have been quick to appreciate what they conceived to be the weak feature in this policy of concentrating the fighting strength in a few large units, rather than in many smaller ones. Periodically, the small, cheap "kill-all" device bursts upon an awestruck world, and forthwith the wiseacres shake their heads and predict a complete "revolution" in naval construction. Our contemporary is not by any means the first that has consigned "our enormously costly fleet to the scrap heap without a moment's warning."

The naval revolutionist is ever in our midst; and not even the contemplation of the large and ever-growing list of naval engines of destruction that fail to destroy, deters each new annihilator from being duly heralded as sounding the death knell of every battleship afloat.

There was the torpedo boat, "a single new invention" which caused all the naval powers to set afloat whole squadrons of these now discredited craft. For the torpedo boat was met first by the rapid-fire gun and the torpedo net, and then by the destroyer, a larger edition of itself, swift enough to catch, powerful enough to sink the torpedo boat. The predicted revolution never took place; and the battleship continued to grow steadily in size, power, and price. Then came the submarine ram, which was to usher in another revolution. Great Britain built her "Polyphemus," and the United States her "Katahdin;" but the former was stricken long ago from the lists, and the latter has already found a post of interest, if not of honor, in our museum of naval curiosities. It was a fascinating idea, this of a turtle-backed, submergible ram, hard to see, impossible to hit, running amuck through a fleet of these "big-navy men" battleships, and sinking them with pitiless deliberation. Nevertheless, the Spanish war came and went, while the "Katahdin" lay rusting at her moorings.

The next annihilator was the awe-inspiring "dynamite gun." Here, surely, was that "single, new invention or development," that was to prove a veritable demon of destruction—worth just as many battleships as happened to come within range of its shells. Why spend so many years in building a 16,000-ton "Connecticut," when in one-fifth of the time one could set afloat a dozen "dynamite cruisers," bearing the awesome name "Vesuvius," and each capable of sinking a battleship a minute by the very simple expedient of tossing a quarter of a ton or so of dynamite aboard from her pneumatic guns? We shall not soon forget that queer little midnight comedy, when the "Vesuvius" drew stealthily within range of Santiago harbor, and proceeded to scatter "earthquakes" among the rocky bluffs of the Cuban coast.

Just now the "single new invention or development" which is to "consign our enormously costly fleet to the scrap heap," appears to be the submarine torpedo boat. We are willing to admit that the submarine has proved terribly destructive, and in every case "without a moment's warning;" but unfortunately, in place of consigning our own or any other "enormously costly fleet to the scrap heap," its chief exploit seems to have been that of consigning its unfortunate crew to untimely and most hideous death. It is probable that there is no "single new invention or development" which, in this respect, has so unique a record. It is a gun which kills at the wrong end of the barrel, and until this latest "annihilator" shall have given over slaying its friends, we shall be forced to the conclusion that not to the submarine is to fall the honor of consigning our fleets to the scrap heap.

As it has been, so it will be. There has been much evolution, but no revolution, in the growth of the fighting ship to its present bulk and power. To the country that can concentrate in greatest numbers the big battleship, with its combination of a steady platform, long-range heavy guns, a large reserve of buoyancy, and good speed (to say nothing of its trained personnel) will the victory of the future and the ultimate blessings of permanent peace belong.

ELECTRIC RAILWAYS AND POPULATION.

Some interesting illustrations of the extent to which the outer areas of cities have increased through the development of the street railway are to be found in the recent report of the Census Office on American Street and Electric Railways. For instance, the population of Manhattan borough of New York city increased from 1,441,216 in 1890 to 1,850,093 in 1900, or 408,877. Of this increase, 231,556, or considerably more than one-half, took place in that part of the island lying north of Eighty-sixth Street, the population in this section having practically doubled during the decade. This district is situated about seven miles from the southern extremity of the city, and the great majority of its breadwinners do business downtown and make daily use of the street railways. In the Bronx borough the population increased from 88,908 to 200,507, the increase being mainly along the street and elevated railway lines. In Brooklyn and Queens boroughs the increase in population was 39 and 76 per cent, respectively, and in each case the advance was mainly in the outlying wards.

Another conspicuous illustration of this influence is furnished by the city of Boston. Of the seven wards lying nearest to the business center of Boston, five showed a decrease in population, while in the outlying wards there was an increase of 93,395 inhabitants, or nearly five-sixths of the total increase of Boston. Moreover, the population of the immediately adjacent cities of Cambridge, Somerville, Chelsea, and Brookline increased much more rapidly than that of the older parts of Boston. A very considerable proportion of the breadwinners, both of the outlying wards and of the adjacent cities, are employed in the business district of Boston and depend upon the electric railways for their transportation.

The change in the distribution of the population of Philadelphia since 1890 has been remarkable. Almost all of the wards in the heart of the city show a decrease in population, while several of the large outlying wards to the west and north of the business center have added greatly to the number of their inhabitants. Moreover, the electric railway has given a powerful impetus to suburban life, not only for residence but also for manufacturing purposes. The effect of this influence is shown in the increased population of the suburbs of Boston and Philadelphia, two cities whose suburban residents are served largely by electric railways. Other cities showing this influence in a marked degree are St. Louis, Milwaukee, and Cleveland.

The presence of a rapid and cheap means of passenger transportation permits manufacturing and commercial establishments to be located conveniently and economically and allows the concentration of retail and wholesale trade and office business in specialized centers. The change thus noted has had a marked influence upon the value of land, and upon rentals and building operations, for every extension of an electric railway line into new territory increases the selling and rental values of the real estate in the vicinity. Thus the clearly marked effect upon the community of the increase of electric railway facilities is to prevent overcrowding and to promote equalization of values.

The effect of street railways in concentrating business is evident, although there are no satisfactory statistics regarding the degree to which the business of cities has become concentrated in narrow areas. It has been estimated, however, that the daily movement of people into the central section of Chicago by means of the surface street railway alone is about 225,000, while a still larger proportion of the traffic of the elevated railways is to and from the same business center, which has an area of scarcely more than a square mile. It has also been estimated that the day population of Manhattan Island below Canal Street is about half a million greater than the night population. Practically all of this enormous number of persons is carried to and from this section by the electric railway.

THE GEORGE WASHINGTON UNIVERSITY.

BY N. MONROE HOPKINS, PH.D.

Active steps are now being taken to expand the George Washington, formerly Columbian, University, and to make of it an institution of national character. These plans provide for a great post-graduate university, with every advantage for advanced study and higher research. It is also proposed to have numerous affiliated colleges, like the system which prevails at Cambridge and Oxford in England. George Washington, in his last will and testament, expressed a desire to have in the capital city of the country just such an institution as this university is about to become, and his ideal will doubtless be realized.

The George Washington University was organized by an act of Congress on February 9, 1821, under the name of the Columbian University, and its name has recently been changed. It may be of interest to sketch briefly the causes which led to this change of name. The change was made on June 8, 1904, by unanimous vote of the Board of Trustees, and on June 22, 1904, the Secretary of the Interior and the United States Commissioner of Education approved the change, the action having been taken under Congressional sanction given on January 23 of the same year.

For a long time Columbian University had been confounded with Columbia University of New York, and there had long been a wish on the part of those interested to secure a name more national in character. It happened that in May, 1897, a large body of patriotic women from all sections of the United States held a meeting in Washington and organized the George Washington Memorial Association. Its objects, as stated in its articles of incorporation, were "To advance and secure in the city of Washington a uni-

versity for the purpose and with the object substantially set forth in and by the will of George Washington, the first President of the United States, and to increase the opportunities for the higher education of the youth of the United States."

There was an immediate response to the appeal of the association for money for a permanent building fund, to be held in trust by the association for the erection of a George Washington memorial building in the city of Washington. This fund, amounting to half a million dollars, is to be devoted to the building of the central administration building of the university. This structure will be the center of the proposed group, and will be surrounded by the other buildings, all of equal architectural worth.

Upon the day that the name of the university was changed, Columbian College was organized, as the first of the affiliated colleges of the university. The old name of the institution is, in this way, preserved. Columbian College has charge of the undergraduate students, under the direction of the Board of Trustees. There will also be departments of Arts and Sciences, covering Engineering, Chemistry, Biology, Physics, Astronomy, Geology, Mathematics, Languages, etc., and departments of Politics and Diplomacy, Law, Medicine, Public Health, Bibliography, and Library Science, etc.

The site upon which the new university buildings are to be erected is one of the most desirable in Washington. Fronting upon the President's Park, just south of the White House, the site faces upon the south of the new Potomac Park. The river is less than half a mile away. When George Washington outlined his plans for a national university, the site which he designated was not very far from the one which the new university has acquired. Immediately surrounding the new site are perhaps 1,000 acres of government grounds, including the Potomac Park, which, when completed in the near future, will give the George Washington University the most beautiful campus in the country.

The proposed colleges will have their own faculties and boards of trustees, like Columbian College, and, with the facilities already at hand, there will be no place in the world where the advanced research worker can obtain better facilities than at the George Washington University. The splendid Library of Congress, as well as the special libraries of the various federal institutions, are always available to the students, as well as the government laboratories. In many of the government bureaus are scientists of the very highest rank, who may be called upon for assistance, while many of the numerous types of scientific apparatus are at the disposal of the faculty and the students of the George Washington University. For many years, by act of Congress, these courtesies have been shown officers and students of the institution and, with its expansion, will doubtless be increased. The university works in harmony with the following celebrated organizations, which make the city of Washington a great university in itself: The Smithsonian Institution, the National Museum, the United States Bureau of Standards, the United States Patent Office, the Engineering Bureaus of the War and Navy Departments, the United States Navy Yard, with its model-testing tank for ship models, and where the factory which makes the guns for the navy is situated; the United States Army War College, the United States Weather Bureau, the United States Engineer and Signal Corps, the Agricultural Department, with its many laboratories; the Engineering Department of the District of Columbia, the United States Coast and Geodetic Survey, the United States Geological Survey, the Carnegie Institution, the United States Naval Observatory, etc. Many large private plants, modern in every particular, are also located in Washington, and to these the student of engineering is admitted for study and work. Probably the next of the affiliated colleges will be a College of Engineering, with an equipment second to none in the country. The university publishes regularly scientific bulletins, which may be obtained, together with any additional information desired, by communication with the Registrar of the University.

THE HEAVENS IN APRIL.

BY HENRY NORRIS RUSSELL, PH.D.

When we return to our observation of the evening sky this month, we will notice that all the constellations are farther west than they were at the same hour a month ago. For example, Orion and Taurus, which were well above the horizon at nine o'clock on a March evening, have now sunk so low that they are almost setting, and the other stars have similarly altered their apparent position.

This does not mean that the stars have really moved at all, but that the sun (from which we take our time) has moved eastward among the stars and come much nearer to these constellations than it was before. Consequently, they are not as high up at sunset or at any given hour of the evening as they were a month ago, and they set earlier—two hours earlier every month—which brings them round to the same time again at the end of a year. A description of the position of the constellations that holds good for 9 P. M. in the middle of a month is therefore valid for 8 P. M. at the end of the month or 10 P. M. at its beginning, and so on.

Having thus specified our hour of observation, let us examine the sky. Orion, Taurus, and Canis Major, which we studied last month, are now low in the west. Above them lies the Milky Way, in or near which are a number of prominent constellations.

Beginning in the extreme northwest we find Cassiopeia, marked by a zigzag line of five second-magnitude stars. There is nothing else like this group in the heavens, and as in our latitude it never sets, it forms a "landmark" in the sky second only to the Great Bear itself. Some distance farther to the left is a very bright star, Capella, in Auriga. This constellation contains several other fairly conspicuous stars which lie to the left of Capella or below it and form a large irregular pentagon easy to recognize. Between Auriga and Cassiopeia is Perseus, which contains two second-magnitude stars and numerous fainter ones.

South of Auriga and above Orion is Gemini. The two first-magnitude stars, Castor and Pollux, which are much closer together than any two other stars of equal brightness that we ever see, make this a very easy constellation to identify. Castor—the northernmost, and somewhat the fainter of the two—is a remarkable double star, consisting of two components of unequal brightness which revolve about one another in a period of several hundred years. Just how long the period is, we do not know, but the stars have not got half way round since the invention of the telescope. Spectroscopic observations have recently shown that each of these bright stars has a dark companion revolving about it in a period of a few days, so that the system is really quadruple. Finally, there is a ninth-magnitude star not far from the bright pair which shares their proper motion, and is undoubtedly a member of the system, describing its own enormous orbit about the brighter stars, though at such a distance that it probably requires 50,000 years to complete one revolution.

The two bright stars and their distant companion may be seen with any telescope of above three inches aperture. The close pairs, however, must be far beyond the power of even the greatest telescopes.

The rest of the constellation Gemini lies below Castor and Pollux toward Orion, and consists of two roughly parallel lines of stars.

South of Gemini is an isolated bright star, which is Procyon, the only conspicuous feature of Canis Minor. Like Sirius, this star is relatively very near the sun, and its light takes only about ten years to reach us.

The most prominent constellation near the meridian is Ursa Major, which is now right overhead. The familiar "Dipper" forms the hind quarters and tail of the Bear. Three of its paws are marked by pairs of stars which lie along a line some 20 deg. southeast of the Dipper, and its head is formed by several faint stars between the Pointers and Capella.

Below Ursa Major is Leo, which has one star of the first magnitude, Regulus by name. Above this is the group known as the "Sickle," which well deserves its name. (Regulus is at the end of the handle.) Two second-magnitude stars about 30 deg. to the left belong to the constellation, being in the Lion's hind quarters, while the bend of the sickle outlines his head.

Between Leo and Gemini is Cancer, the least conspicuous of the zodiacal constellations, marked only by a little hazy spot of light which a field-glass will show to be a star cluster. It has been known since ancient times by the name of Praesepe, the Bee-hive.

Below Cancer is a little group of stars which marks the head of Hydra. This is a very large constellation which extends southeastward for about 90 deg. but contains no bright stars. The quadrilateral in the southeast, which is the most prominent object in that part of the sky, represents Corvus, the Raven, which is perched on Hydra's head.

The bright star in the southeast is Spica, in Virgo, and the still brighter one farther north is Arcturus, in Boötes. These constellations, however, together with Corona and Hercules, which are now rising, can be better seen and described in later months.

From the Lick Observatory comes the news of the discovery of another satellite of Jupiter found photographically by Prof. Perrine with the Crossley reflector. It is of the sixteenth magnitude, that is, so faint that it can only be seen with instruments of the largest size. From the manner of its discovery it is clear that it must be a distant satellite with a long period similar to the recently-discovered ninth satellite of Saturn and the still more recent sixth satellite of Jupiter.

THE PLANETS.

Mercury is evening star until the 23d, when he passes between us and the sun and becomes morning star. During the first part of the month he is very well visible in the evening. On the 4th he is at his greatest elongation from the sun and sets at about 7:45 P. M. He is in Aries, a few degrees south of the brightest star of that constellation.

Venus is also evening star till the 27th, when she also becomes morning star. She is conspicuous at the beginning of the month, when she sets two hours after the sun, but disappears from view about the 20th.

Jupiter is also evening star in the same part of the sky and the three planets are quite near one another. On the evening of the 25th Mercury and Jupiter are about 5 deg. apart and at about the same altitude above the horizon. Jupiter is the southernmost of the two. Venus is directly above them, about 10 deg. higher up. The moon will be near them all on the 6th.

Mars is in Libra and is becoming brighter as he approaches opposition. He rises at about 9 P. M. on the 15th and is the most conspicuous object in the southeastern sky at midnight.

Saturn is morning star in Aquarius, rising between 3 and 4 A. M. Uranus is in Sagittarius and comes to the meridian at 4:40 A. M. on the 15th. Neptune is in Gemini and sets about midnight.

The asteroid Vesta, the brightest of these small planets, was in opposition on March 24 and is now visible. Her position is as follows:

	R. A.	Declination.
March 30...	12h. 26m. 3s.	10 deg. 49 min. N.
April 11.....	12h. 15m. 7s.	10 deg. 47 min. N.
April 23.....	12h. 7m. 4s.	12 deg. 7 min. N.

So that she is near the line joining β Leonis and γ Virginis about one-third of the way from the former toward the latter. She is about the 6½th magnitude, just visible to a keen eye. By making a diagram of the small stars visible with a field-glass in this region the asteroid may be identified by its motion.

THE MOON.

New moon occurs at 6 P. M. on the 4th, first quarter at 5 P. M. on the 12th, full moon at 9 A. M. on the 19th, and last quarter at 6 A. M. on the 26th. The moon is nearest us on the 18th and farthest off on the 4th. She is in conjunction with Saturn on the 1st, with Mercury, Venus, and Jupiter on the 6th, Mars on the 21st, and with Saturn again on the 28th. The two conjunctions with Saturn are fairly close.

Capri, Italy.

SCIENCE NOTES.

The constant effort of science to overcome natural laws as well as to apply them must be recognized. A few years ago, at a meeting in New York, a gentleman was deploring the fact that we did not allow nature's laws to have full play; that we were constantly antagonizing nature at the expense of the welfare of the human race. Mr. Abram Hewitt answered this pernicious doctrine by saying that if nature had been allowed to take its course, grass would still be growing in Broadway.

Are metals made radio-active by the influence of radium radiation? This is a question which Prof. Thomson, F.R.S., answered in a communication made to the Cambridge Philosophical Society recently. From experiments made on lead, brass, and tin, it was shown that these bodies, after exposure to radium radiation, exhibit no trace of radio-activity four minutes after the radiation has ceased to fall upon them; there was no evidence of induced activity of any kind, but the method used was not adapted for testing the existence of a very short-lived radio-activity.

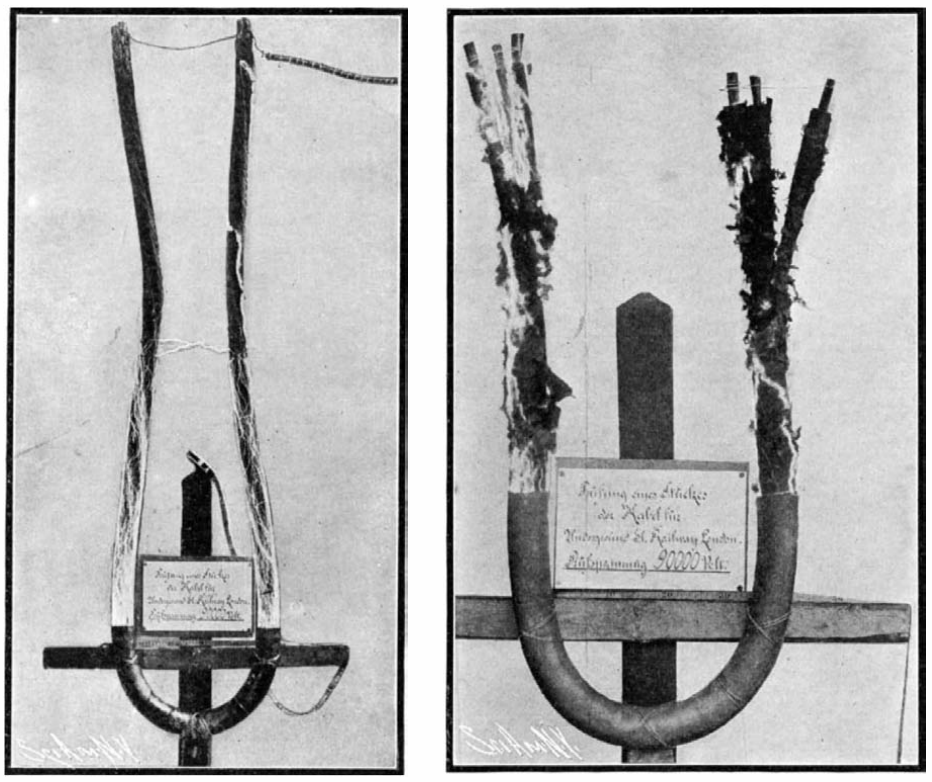
Cuvier, the naturalist, while a young man incurred the enmity of certain of his colleagues, who decided to give him a severe fright by dressing one of their number in the conventional garb of Satan and making a midnight call upon him. It is presumable that being aroused from a sound sleep, Cuvier was duly impressed with the figure before him and that some of the threats made were having the desired effect. But finally, in a last effort to overwhelm him, the devil threatened to eat the young scientist. This was a fatal mistake, for Cuvier, at once reassured, eyed the grotesquely-clad figure from head to toe and exclaimed, "What, horns and hoofs and carnivorous! Never!" He then rolled over and went to sleep.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1526, opens with an excellent and very fully illustrated article by Charles H. Dodge on a new Mexican substitute for cordage fiber. L. E. Neame writes on "Mysterious White Races." The famous chemist, Prof. Arrhenius, discusses in a very simple and instructive way the development of the theory of electrolytic dissociation. Arthur Churchill writes eloquently of Edison and his early work. Charles R. King's splendid article on the completion of the Simplon tunnel is concluded. William Scott Taggart, the author of "Cotton Spinning," presents an easily understood description of cotton gins. The strength of timber treated with preservatives is discussed. The Pintsch suction gas producer is described and illustrated. The English correspondent of the SCIENTIFIC AMERICAN writes interestingly on the Just-Hatmaker process of manufacturing powdered milk.

CABLES THAT WITHSTAND 90,000 VOLTS.

The distances to which the electric current is transmitted are continually increasing, and, with the distance, increases the tension of the current; but, with the tension, the insulating properties of conductors, and especially of cables, must also increase. Marked progress has been made in recent years in such insulation, and the best proof of this is the fact that some cables have recently resisted tensions of 90,000 volts. Such cables have been furnished by the Allgemeine Electricitäts Gesellschaft, of Berlin, to the Underground Railway Company of London. The cables are composed of three conductors, each having a cross section of 195 square millimeters. Each conductor is insulated by a layer of paper 11 millimeters (0.433 inch) in thickness, and the three conductors collectively are covered with a layer of paper 11 millimeters in thickness and an outer casing of lead. The diameter of the cable thus becomes 72 millimeters (2.834 inches). A cable of such length and thickness bent into a loop not exceeding five times the external diameter of the cable, should resist 33,000 volts. For testing the cables, the three conductors were placed under tension and the lead casing was grounded. The insulating material was not pierced at 90,000 volts. Some previous experiments showed that the upper layer of the insulator becomes heated so strongly and so instantaneously that the surface of the paper that covers the cores is torn, and that the tension does not pierce the insulation between the lead and the conductors. Paper is therefore an excellent insulator, but has the drawback of causing a loss of flexibility in the cable when the insulating layers have to be thick. This trouble has been remedied by adding to the material with which the paper is saturated a larger quantity of thick oil. The cable thereby becomes more flexible and the insulation still more efficient.



CABLE SUBJECTED TO 90,000 VOLTS TENSION.

THE PROGRESS OF AVIATION SINCE 1891.

Since 1891, when Lilienthal, after twenty years of calculation, experiment, and observation of soaring birds, made his first flight of 15 meters, aviators have been in possession of a method. The main difficulty is to start, as the aeroplane cannot be floated without considerable initial relative velocity. This Lilienthal acquired by running down hill against the wind. Between 1891 and 1896 he made more than two thousand flights, some of which exceeded 100 meters. If the wind freshened during the flight he was lifted, sometimes higher than his starting point, and could prolong his flight. He landed easily by raising his wings, as birds do, to check his forward motion. He omitted the motor as useless at the first stage, for he adopted the process of evolution and chose as his first model, not the intricate flight of the most adept fliers but the soaring of species like the flying-fish and the grasshopper, which are learning to fly.

Lilienthal proved that a slightly convex surface of 20 square meters, inclined from 7 deg. to 10 deg. to the wind and moving against it with a relative speed of 10 meters per second would sustain a total weight of 100 kilogrammes. He showed, too, that the problem of equilibrium is more difficult than that of motive power. The aviator, like a bicyclist or a soaring bird, is constantly engaged in regaining his lost equilibrium. Lilienthal did this by thrusting out his legs forward and laterally. In this unnatural exercise he acquired great skill which, however, did not prevent his falling to his death in 1896.*

The first of his followers, the Englishman Pilcher, used a similar apparatus, but raised it like a kite by means of a rope to which swift horses were attached. When high enough he gradually bent forward, loosed the rope and swooped down like a crow alighting in a meadow. He was killed in an attempt made in a storm in 1899.

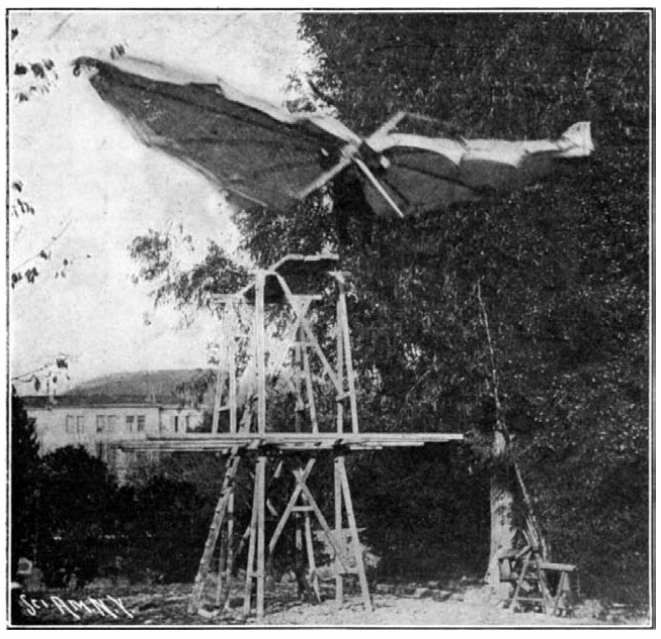
In 1896 Chanute, of Chicago, who had studied the theory of aviation and published an exhaustive history of the subject, made, with his assistants, Herring and Avery, a practical trial of the Lilienthal type of machine, but soon abandoned it on account of its instability and returned to his own plan of making equilibrium automatic by the use of several surfaces. In such an arrangement inclination forward causes increased pressure on the upper while inclination backward has a similar effect on the lower wings, the result in either case being to right the vessel. At first Chanute used five pairs of wings, but his final model contained only two parallel surfaces and resembled a Hargrave† kite moving sidewise. An elastic tail‡ favored equilibrium by increasing the moment of inertia and keeping the head to the wind.

(*Continued on page 262.*)

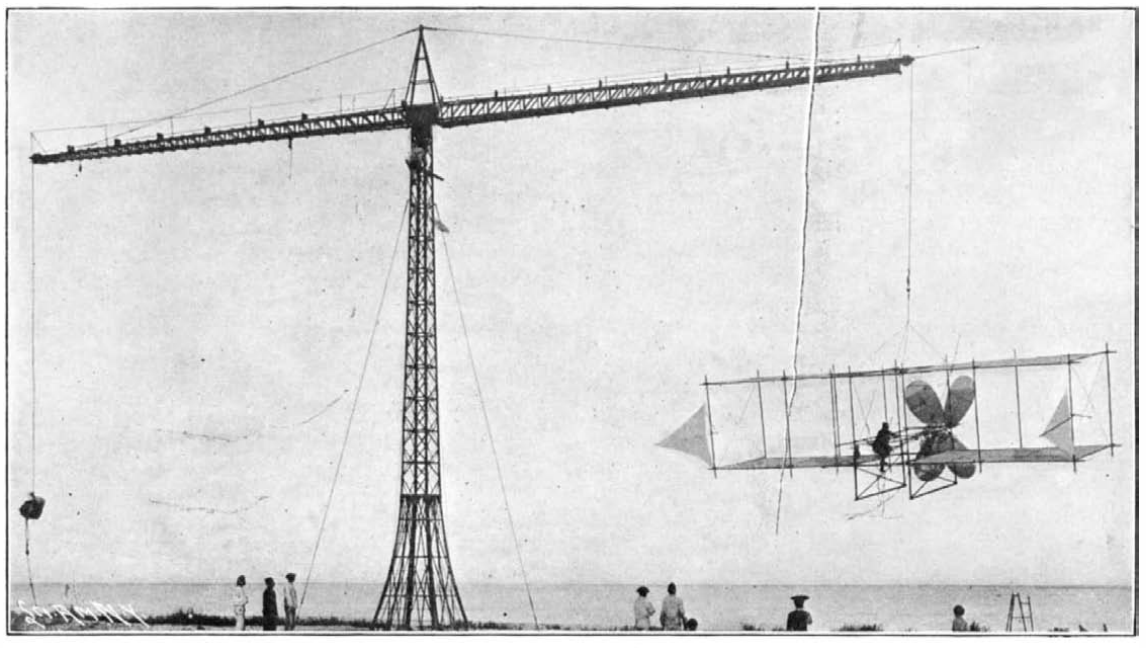
* Le Bris, a French sailor, derived from his observations of the albatross an idea identical with Lilienthal's. Adopting Pilcher's kite method of starting, he made some attempts in 1867, but poor success, accidents and lack of money forced him soon to abandon his experiments.

† L. Hargrave, of Sydney, Australia, inventor of the cellular kite and more than a score of successful aeroplane models.

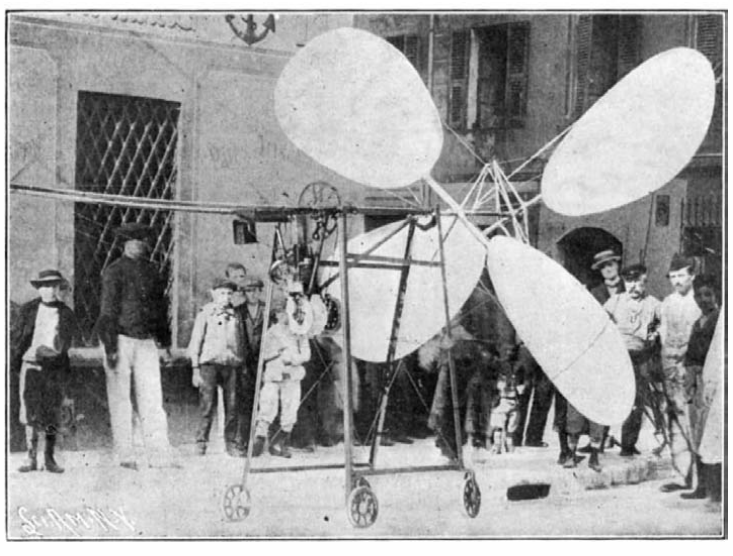
‡ Pénaud, in 1871, invented the first successful aeroplane with a flexible tail. He died in 1880 at the age of 30.



Capt. Ferber's Aeroplane No. 4.



Capt. Ferber's Aeroplane No. 6 Undergoing a Test.



The Motor and Propeller of Aeroplane No. 6, designed by Capt. Ferber.

A Flight That Ended in a Fall Because the Wind's Direction Had Not Been Considered.

THE PROGRESS OF AVIATION SINCE 1891.—CAPT. FERBER'S EXPERIMENTS.

A SWIMMING SCHOOL FOR CAVALRY HORSES.

BY W. G. FITZ-GERALD.

No amount of improvements in artillery and small arms has done away with the cavalry arm in modern warfare; and the question of getting horses for this branch of the service is a very serious one. Now horses, it may not be generally known, display almost as much individuality as human beings; and this remark as to the diversity of their natures applies with special force to military chargers, which must of necessity be recruited in all parts of the world, from Hungary to Buenos Ayres.

The army of every great power has a veterinary department, whose officers and men are charged, not only with the maintenance and care of many thousands of war horses, but are also responsible for their purchase in the first instance, and likewise their education, which is almost as important as that of their rider.

Just consider how mixed a few "bunches" of cavalry horses may be that have just been received in Paris, Berlin, Vienna, Rome, or London. Some have been bought on the Siberian steppes; others among the hills of Bohemia; others, again, in our own Western or Southern States; some in Ireland; and so on.

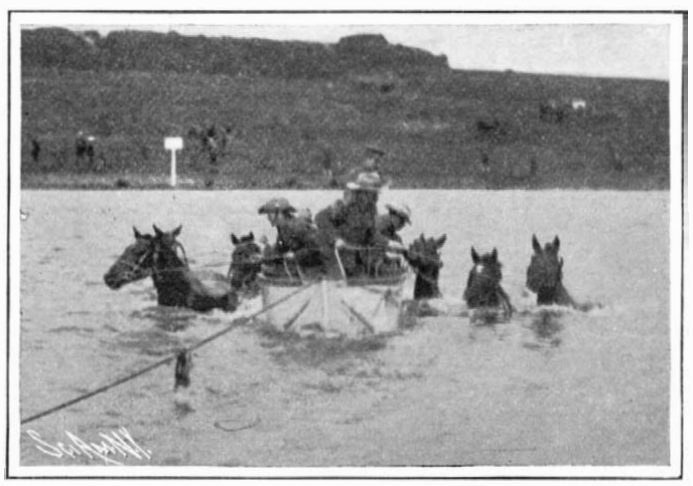
All of them have been differently brought up, amid surroundings as varying as those of their human masters, and now their military education must begin. Some of them may not even be broken to the saddle. They are all pretty much of one age, but their health may vary, and their temper certainly does.

One of the first things to be done with the equine recruit is to accustom him to the sound of drums and military bands as well as sharp trumpet calls, volleys of musketry; and last of all the trembling beast has to face and stand by roaring and thundering artillery.

You would have thought all these more or less severe tests, but alas! there is one more coming for the poor horse, that must make him wonder—if horses wonder at all—whether life is worth living. This is his swimming exercise, which is so vitally necessary a part of his training, in order that in a time of need, when an enemy may have blown up and destroyed existing bridges, he may readily cross flooded rivers, taking his fully-equipped rider with him, and even hauling boats, laden with stores, provisions, and ammunition, from one bank to another.

Most of the horse recruits have a more deep-seated aversion from water than has even the workhouse tramp. It is almost pitiful to see them tremble on the brink, and strive to get away from the unstable element. Many of the great powers of Europe set apart special sections of a river, lake, or reservoir for the compulsory training of cavalry chargers in this manner. As the system obtaining in most armies is identical, it will be enough if we consider that practised at Aldershot, the great military camp of England. Hither are drafted horses from most of the other military camps, such as Hunslow, York, Winchester, Colchester, etc., for this is their swimming "university." In the nature of things, the "professors" are not overburdened with clothing, and it is to be feared no gentle measures are used with recalcitrant pupils.

Assembling the Boats.



Swimming Across a River.

Packing Up the Collapsible Boats.

A SWIMMING SCHOOL FOR CAVALRY HORSES.

At first coaxing is the order of the day. The animal is well fed with barley on the morning of his first lesson, and then he is led forth casually, as though for a little ordinary exercise, by the military stableman in whose charge he is. He is led down to the river's edge, where are assembled a number of specially-made collapsible boats of canvas and ash framework. These may be used to compel and tow the reluctant equine swimmers; or on the other hand, they may be filled with men and stores and towed to deep water by more proficient pupils. The horse is permitted simply to look at the water at first, and then he is patted and coaxed in, first up to his fetlocks, and then to his knees. Beyond this he will rarely go at the first lesson. He is kept at this depth for some little time, and then taken for a little run on land.

He is brought back again, however, and coaxed in a little deeper, and if he show any sign of pluck and readiness to take the plunge into deep water, the cavalryman attending him divests himself of the scant clothing he carries, and prepares to swim by the horse's side to encourage him with voice and hand, and probably take him back again after he has made one trip.

Sometimes heroic measures of a violent nature are resorted to, and a timid or trembling pupil is hauled or thrown into deep water without further ceremony. Sometimes this has the desired effect, and the animal finds that after all the experience is not so very terrible; indeed, he may well find it most refreshing on a sweltering August day on the Hampshire Downs, where there is little or no shade from the burning sun. On the other hand, such a course may give a horse a fright of which it may be difficult or even impossible to cure him. Some of the horses indeed—more particularly those from Asiatic Russia, where the rivers are frozen to a depth of several feet for the greater part of the year—have an unconquerable aversion to entering the water to any depth; and if they are found to be quite hopeless, they are drafted into other branches of the service. At the same time, commissariat horses and mules, as well as artillery teams, are educated in this way, besides the chargers of the cavalrymen. The men chosen for this work are all veterinary officers, commissioned and non-commissioned, and as a rule they are patient and kindly men, with an extensive knowledge of the leading peculiarities of all the horses of the world.

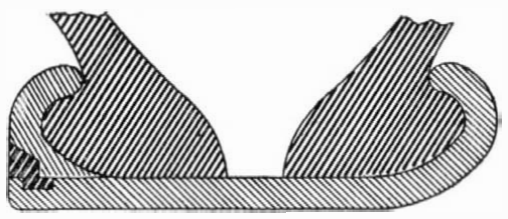


Fig. 1. Full-Size Cross-Section of Rim, Showing Clincher and Locking Rings on the Left.

A SIMPLE RIM FOR DETACHABLE TIRES.

The latest improvement in the method of fastening a double-tube pneumatic tire to the rim of a wheel in such a way as to make it readily detachable, has just been brought out by the Bryant Steel Wheel and Rim Company, of Columbus, Ohio. The new rim is the invention of Mr. Richard S. Bryant, of this company, and it is the simplest device we have seen for securing an ordinary clincher tire.

The construction of this new rim can be readily seen from the cross-sectional cut, Fig. 1, while the ease with which a tire can be detached when mounted on such a rim, is apparent from the photographs.

Referring first to the cross-section, the reader will

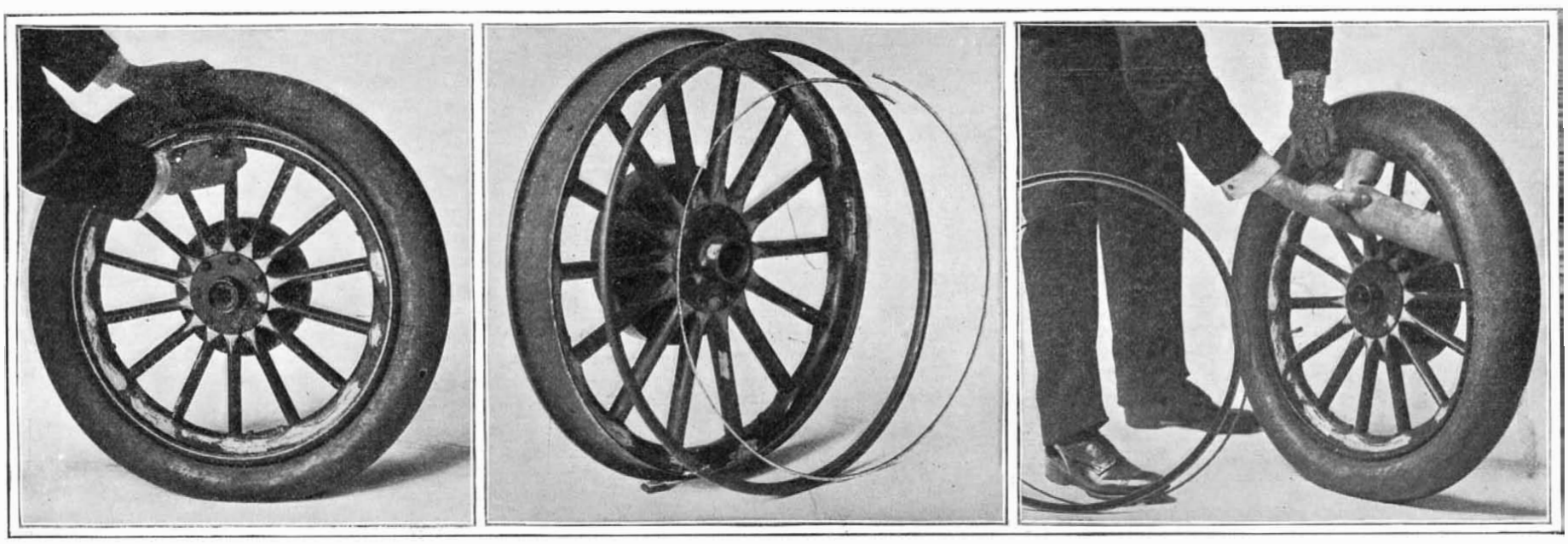


Fig. 2.—Removing the Small Locking Ring. Fig. 3.—The Rim with Clincher and Locking Rings. Fig. 4.—Removing an Inner Tube.

A NOVEL RIM, MAKING POSSIBLE THE REMOVAL OF A DETACHABLE TIRE WITHOUT THE USE OF TOOLS.

note that the tire is mounted on what appears to be the usual steel clincher rim. As far as the bottom and inside edge of the rim is concerned, this is correct, though the flat face of the rim has a small groove in it near its outside edge. The outside clincher ring is entirely separate from the rim, and it too contains a groove on its outer edge that matches the groove in the rim, being nearly opposite it when the tire and clincher ring are in place. As soon as this is accomplished, all that is necessary to secure the tire is to crowd it against the inner clincher ring sufficiently to allow of inserting the light locking ring in the rim (see Fig. 2). This ring is of the special cross-section shown in Fig. 1, and when the tire is inflated, it takes all the side pressure exerted by the inner tube and casing upon the outer clincher ring. If the tire is deflated, the weight upon it will, it is claimed, still keep the ring in place. The outer surface of the locking ring is flush with that of the clincher ring, there being no projections to come in contact with the curb, nor any crevices or openings through which dirt or water can penetrate. Rims of this type can be fitted to any wood wheel and can also be adapted to any style of clincher tire. Besides being extremely simple in construction, this form of attachment offers the great additional advantage that no tools whatever are required to remove an inner tube. This of course can be done in a minimum of time and with practically no exertion, by pressing in on the deflated tire and removing the split locking ring (Fig. 2), whereupon the clincher ring will come off and the tube can be removed (Fig. 4) or the complete tire be taken off (Fig. 3) if necessary.

The new rim has been tested by the inventor on a heavy touring car throughout the past year, and has been found to work satisfactorily. That it will be a boon to automobilists, to whom the repair of tires by the roadside is one of the greatest drawbacks of the new locomotion, is obvious to all.

THE PROGRESS OF AVIATION SINCE 1891.

(*Continued from page 260.*)

Hundreds of "gliding experiments" were made without accident in 1896-7, the longest flight being 109 meters with a descent of 10 deg. The equilibrium was so nearly automatic that the aviator never had to move more than 60 millimeters.

In 1900, on the dunes of Kittyhawk, N. C., the brothers Orville and Wilbur Wright began their experiments with a Chanute or two-surface aeroplane, but replaced the long and awkward tail by a horizontal rudder at the bow,* and lay on their faces to lessen air resistance. Two assistants ran with the apparatus against the wind unless the latter exceeded 8 meters per second, when a standing start could be made. The machine rose, recoiled a little, then, answering the helm, set itself parallel to the slope and glided forward. On reaching the bottom of the dune it rose slightly in obedience to the rudder and, its speed being thus checked, alighted like a bird. In 1901-2 the Wrights made hundreds of flights, some of 300 meters. In 1902 they added a vertical rudder at the stern and flew in curves. Finally, in 1903 they succeeded in hovering over one spot by rising with a brisk and variable wind, gliding forward when it lulled and drifting backward and upward with each gust. They hovered for 72 seconds without advancing more than 30 meters.

This result rehabilitates the scattered minority that for forty years has contended that certain birds remain aloft without exertion. It is now certain that this occurs with ascending air currents. Such currents are common in the mountains, and so are soaring birds, but neither is found on the plains. There is a certain analogy between a sailing vessel and an aeroplane. The former tends to approach a definite vertical, the latter a horizontal plane. These skillful experimenters sailed within 6 deg. of the horizontal—doing almost as well as vultures--and they hold in their hands prompt and complete realization of flight.

In December, 1903, they began to experiment with a machine of 50 square meters surface and 12 meters breadth, weighing 338 kilogrammes and having astern two screws driven by a 16-horse-power motor. Starting on level ground from an inclined monorail they made four flights, the longest of 59 seconds at a speed of 16 kilometers per hour relatively to the ground. December 17, 1903, marks the date of the first real flight of a manned flying machine and the honor of this memorable achievement belongs to the Wrights.

The French newspapers having spoken of Lilienthal's apparatus as a "parachute," it was not until 1898 that I learned its real nature from an old copy of the Illustrirte Zeitung. Convinced that Lilienthal had discovered, if not the art of perfect flight, at least the way to learn to fly, I determined to follow his method. My first model, whose length exceeded its breadth,† was dashed to pieces at the first trial. The second, flown as a kite, proved unstable. No. 3, with 15 square meters surface, 7 meters wide, and weighing 30 kilogrammes, proved unable to sustain my weight. No. 4, of the same weight and area, but 8 meters wide, was launched in 1901 from a scaffold 5 meters high. It landed gently after a flight of 15 meters, which occupied two seconds. Similar results were obtained from further experiments, but the stabilty was still unsatisfactory.

Then I entered into communication with Mr. Chanute and finally adopted his two surfaces, chiefly because they double the sail area for a given weight and allow the frame to be stiffened like a truss bridge.

My aeroplane No. 5 was of the Chanute-Wright type (weight 50 kilogrammes, width 9.5 meters, length 1.8 meters, sail area 33 square meters). Its first flight, in 1902, was 25 meters, its second 50 meters. Its chief defects, marked lateral deviation and sudden landing due to insufficiency of the rudder, were avoided in 1903 in a slightly smaller machine with two lateral horizontal rudders acting as a keel. This machine, when flown as a kite, exerted a horizontal pull of 20 kilogrammes, whence it was inferred that a screw traction of this amount would keep it afloat.

Then I bought the lightest motor then obtainable, a 6-horse-power Buchet, weighing 39 kilogrammes alone and 90 kilogrammes with its accessories and the twin screws—the last made necessary by the dangerous torque introduced by a single screw. To favor equilibrium by increasing moment of inertia I put all the machinery at the bow and balanced it by the weight of the aviator at the stern. At the rate of 1 horse-power for 50 kilogrammes,* which has been found sufficient for the Chanute type, my motor should drive an aeroplane weighing 300 kilogrammes which, again, should have a sail area of 50 square meters to agree with the ratio of surface to weight observed in large birds. This area was divided into two surfaces 10 meters broad, 2.5 meters long, and 2.5 meters apart. The total weight of the aeroplane (No. 6), allowing 75 kilogrammes for the aviator, was 230 kilogrammes.

Though this marks a record of lightness it is still too great for the methods of starting previously employed. Every aviator has been confronted by this problem of starting. Lilienthal used an artificial hill 15 meters high, Pilcher a kite cord, Langley a catapult, Eiffel proposes to stretch an inclined wire from the first story of his tower, Goupil suggests a circular railway, Bazin has patented an aerial merry-go-round. Though the last introduces centrifugal force, it permits the safe study of continued flight.

So I constructed a 30-meter cantilever pivoted on a pillar 18 meters high and hung the aeroplane over it by a cable having a counterpoise at the other end. I found the maximum traction of the screws, 20 kilogrammes, insufficient for flotation, but military duties postponed the construction of new screws until 1904.

Prof. Langley is not of the school of Lilienthal. After some remarkable experiments on air resistance he proceeded at once, like Maxim and Ader, to construct a complete aeroplane. In 1896 he made the record for unpiloted models with a flight of three quarters of a mile (1,200 meters).†

In 1903 he built a machine large enough to sustain a man's weight which, with Prof. Manley aboard, was projected by springs from a barge and fell into the Potomac after a flight of 30 meters. According to the Scientific American this failure was caused by starting at a wrong angle owing to a defect in the catapult. But why did not the machine right itself? Either because the rudders were insufficient or because Prof. Manley, untrained by previous experience, did not operate them promptly. Here again we see the genius of Lilienthal in mastering equilibrium before attempting propulsion. But the failure is only temporary. Prof. Langley, aided by the government, will correct defects. Prof. Manley will acquire dexterity, and the aeroplane will fly.

In conclusion, I will mention the machine recently constructed at Chalais-Meudon for M. Archdeacon. It is of the Wright type with planes 7.5 meters broad, 1.44 meters long, and 1.4 meters apart, a total surface of 22 square meters, and a weight of 34 kilogrammes. It has a horizontal rudder in front and a vertical one behind. Experiments made with it on the aerodrome by M. Voisin and myself are herewith illustrated.—Abstract of a paper by Capt. F. Ferber in the Revue d'Artillerie.

Several minerals contain thoria. The mineral supposed to be uraninite or pitch-blende proves on complete analysis to be a new mineral, which it is proposed to name thorianite. This mineral is one of the richest known in the rare earth thoria, of which it contains more than 75 per cent, uncombined with silica, and is of very considerable value and commercial importance.

* Birds use their heads as rudders for small and sudden changes, their tails for large ones only.

† Experience proves that a rectangle moving parallel to its shorter side has more sustaining power than a square of the same area, probably because it meets a greater number of fluid filaments. The rear element of the surface seems to have little effect except to increase friction.

* Wright has increased this to 75 kilogrammes. This is a good sign.

† In the same year MM. Latin and Richet launched, near London, a very remarkable model driven by steam which made a flight of 200 meters.

Correspondence.

Some Weather Observations.

To the Editor of the Scientific American:

The article "Grandfather's Barometer," in issue of March 4 contains much truth.

These signs and omens originated when the people lived in the country; their observations covered great distances and it was almost obligatory on them to watch the weather. Those who live in the city are unable to note these signs and are therefore inclined to ridicule them.

Having left the city for the country many years ago, I have observed closely the weather and have noted the following. No. 1 I have found almost always correct, and were one situated so as to be hourly cognizant of the temperature and the force and direction of the wind over a large territory, as is the Washington weather bureau, I believe it would prove invariably so. It applies in this locality from about October 1 to May 1.

1. Double the hours or days from the clearing of a storm to the next calm period; the result will enable one to foretell very closely the coming of the next storm. The sooner the calm, the sooner the storm.

2. When the sun sets between dark banks of clouds with a yellowish red cast, and appearing (to me) like an evil eye, there will be a heavy southeast storm the following day.

3. The same general appearance when the sun rises, but with a reddish yellow cast, is shortly followed by a heavy easterly storm.

4. Long and narrow clouds in the west late in the day, having the appearance of condensed fog and below dark banks of clouds, is an almost sure sign of storm the following day.

5. When the electric lights of the city, viewed from an elevation in the suburbs, scintillate with a peculiar diamond-like brilliancy, a storm shortly follows.

There are other indefinable signs, whereby, like a sixth sense, one can foretell the approach of a storm or the clearing away of a present storm.

I trust these observations will be of value. L.

Worcester, Mass., March 8, 1905.

Astronomical Anomalies.

To the Editor of the Scientific American:

In the English Mechanic of Nov. 4, 1904, under the heading "Astronomical Anomalies," Mr. Fred G. Taylor (letter 345, page 299) presents four queries, with the request that he be helped in his "difficulties"; and as I now have in preparation a book to be entitled "Facts and Fallacies of Astronomy," containing numerous questions for astronomers to answer, and illustrating the errors to be found in various textbooks on the subject, I was much interested in his communication, having given considerable attention to the "contradictions" mentioned by him. Well may we exclaim with the late and lamented Prof. Proctor: "It may well be questioned how far it is just that those who have still so much to learn should undertake to write textbooks of science."

The exact time of the earth's rotation as given in Lockyer's "Elements of Astronomy," to which the above-named writer refers, is of course wrong, and should be 23 hours, 56 minutes, 4.09 seconds. But Lockyer's book, a copy of which I have had in my library for many years, contains other errors equally glaring and surprising, coming as they do from one who is supposed to be an authority on the subject, and in my forthcoming volume I refer to many of his statements which I have corrected and explained. All the queries included by the writer mentioned are important and deserving of attention, but I was particularly interested in query No. 4, in which he says: "Sir Robert Ball, in 'Starland' and elsewhere, says that by looking up a vertical shaft—that of a coal pit for example—the stars may be seen during the day. Maunder, in 'Astronomy Without a Telescope,' chapter 8, treats the statement as an unproved tradition. Again, which is correct? The above are samples of the contradictions frequently met with. If astronomy be an exact science, why in the books mentioned do we find such contradictory statements?"

The belief seems to be widespread, and generally accepted by the public, that the stars may be seen in the daytime from a deep well, shaft, or pit, and it is mentioned as a fact by many popular writers, while others equally well known and eminent treat the belief as a fallacy. In many textbooks and other writings on astronomy the statement is made that stars are visible even at midday from such localities, some going so far as to claim that they may be seen in the tube of any large telescope from which the lenses or mirrors have been removed. As I have never had an opportunity to view the heavens under the conditions mentioned, I am not able to verify the statements from personal observation, and cannot, so far as my own knowledge is concerned, say whether they are true or

false. But it would seem that a belief so widely prevalent, even among scientific persons, must have some foundation, and it would be interesting to know if it has really ever been demonstrated as a fact by observation. I should be glad to hear from other writers in regard to this disputed question, and to know if any have ever "tried the experiment," and been able to corroborate the statements or establish the observations so long accepted as truthful by students of astronomy.

Washington Irving, in his charming story of "The Alhambra," has given currency to this belief, and contributed to the popular error, if such it be, for he thus mentions an observation of the kind: "He caused the cave to be enlarged so as to form a spacious and lofty hall, with a circular hole at the top, through which, as through a well, he could see the heavens and behold the stars even at midday." If this belief is indeed a fallacy, it is surprising that it should have been allowed to remain so long uncorrected and accepted as a scientific fact; and for the benefit of students and the general public, the truth should be known and published in every textbook on astronomy. Any prominent celestial object, such as the moon, a large comet, or the planet Venus when most brilliant about five weeks before or after inferior conjunction, would in all probability be visible from a deep well or shaft, if favorably located directly over the opening, even in bright sunshine, as they are plainly seen by the naked eye in the daytime when not too near the sun. But in my opinion no star, except perhaps Sirius, would be visible in daylight from such a locality, for the very evident reason that the darkness is merely local and does not extend far enough into the sky for any stars to be seen, especially with the naked eye.

Notwithstanding the superficial darkness of the well or other inclosure, the great atmosphere, extending to an unknown height above the earth's surface, would still be brilliantly illuminated, and the diffused light of the sun would, it seems to me, be sufficient to prevent any ordinary star being seen in the daytime even from the darkest and deepest shaft. We should be confronted with a luminous atmospheric envelope compared with which any well or shaft, of whatever size and depth, would be insignificant; and it seems reasonable to conclude that the darkness would not be intense enough, with the glaring sunshine overhead, to render the stars visible under the circumstances we have mentioned.

As an offset and in direct opposition to the statements commonly accepted, we have the positive testimony of Prof. William H. Pickering, the eminent American astronomer, who from actual observation has been able to effectually dispose of the question and refute the popular belief together with another equally prevalent and absurd. The Century Magazine for March, 1903, contains an illustrated article by this well-known writer and observer entitled "An Outlook Into Space," being an account of a far search by American astronomers for an observatory site, in which he says: "This expedition to Pike's Peak helped to destroy one old popular superstition. It had frequently been stated that from the bottom of a deep well or from the top of a high mountain the sky would appear dark even at noon, so that some of the brighter stars could be seen. Observations from the bottom of deep mining-shafts had disproved the first statement, and our expedition disproved the second. From the top of El Misti, in Peru, at an altitude of over 19,000 feet, the sky is somewhat darker, perhaps, than at sea-level—what might be described as a deeper color—but it is not enough so to warrant the old-time belief."

This important testimony, emanating from such a trustworthy and authoritative source, supports my own views expressed above, and appears to establish beyond a doubt the fallacy of the belief which, however, does not reflect in any way unfavorably upon astronomy as an "exact science," as the writer in the English Mechanic seems to imagine. I am glad that he has called attention to the question, and trust that his letter and my own will arouse an interest in and a further discussion of the subject, which has been so long neglected and misunderstood.

Battle Creek, Mich. ARTHUR K. BARTLETT.

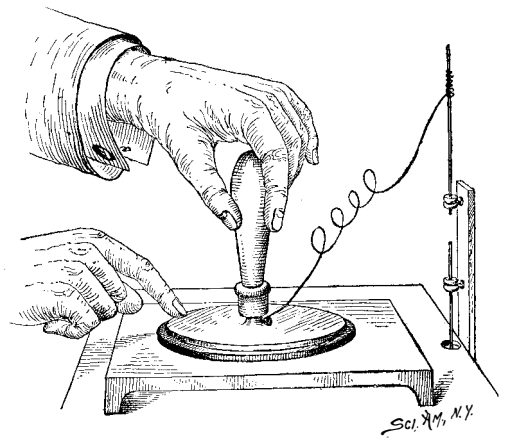
[We have no personal experience on the subject, have not been able to locate any authority who makes this statement, except Ball; and Ball carries a very high reputation for veracity in astronomical circles, which would give his statement some weight at least. There is no question that it is at least very probable that stars should be visible under the conditions mentioned. The reason why we do not see them ordinarily is that the glare of the light diffused by the atmosphere blinds the eyes; even then, Venus can sometimes be seen in daytime. At the bottom of a well, in the dark, the eyes have a greater light-collecting power, owing to the expansion of the pupil, which might make the matter possible, and besides a good deal of the glare that strikes the retina from the sides is cut out. That even a small telescope will show up the brighter stars at any time cannot be questioned. Observations on Sirius are frequently taken in bright sunshine; and records of many such observations can be found in the publications of various observatories. If we are not very much mistaken, the Greenwich annuals contain some, among others.—ED.]

A HOME-MADE WIRELESS SIGNALING TRANSMITTER.

BY A. FREDERICK COLLINS.

In a recent issue of the SCIENTIFIC AMERICAN an account was given of two home-made wireless telegraph receivers; in connection with these it may prove interesting to your readers who are desirous of making their own experimental apparatus, to describe an exceedingly simple form of wireless transmitter.

In sending wireless signals the essential factor is a disruptive discharge or spark, and this should take place between the ends of two wires, one of which



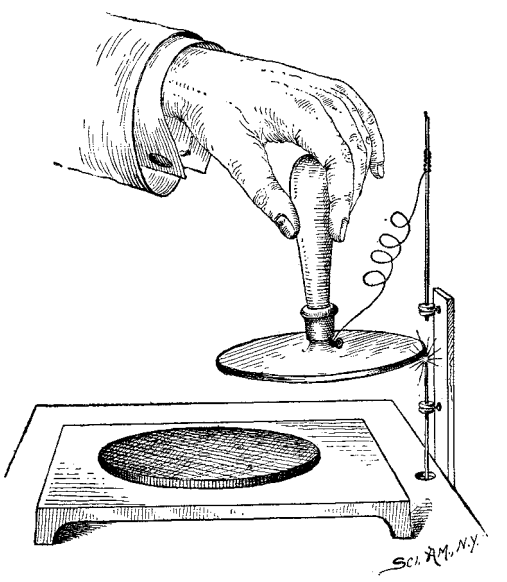
CHARGING THE LID OF THE ELECTROPHORUS.

projects vertically upward in the air, and the other is connected with the earth; or if the signals are to be sent over a short distance, say 15 or 20 feet in a room, the latter wire may be connected to a bit of tin or copper plate and merely allowed to rest on the floor.

The simplest way to obtain an electric spark is by means of an apparatus called an electrophorus, an instrument for generating static electricity by induction. This little device is usually made of a flat disk of resin on which rests a metal disk having an insulating handle of glass or vulcanite.

Our illustrations show clearly the tin or brass plate and resinous disks; and although the former is placed on the latter, their surfaces touch each other in only a few places, since the air forms a thin insulating film which practically separates them.

To construct an electrophorus, it is only necessary to fill a shallow tin pan—a pie-tin answers admirably—with a mixture of resin, Venice turpentine, and shellac in equal parts. When these substances are heated to the melting point, they should be thoroughly mixed by stirring, which should be carefully done so as to prevent the formation of air bubbles. If the turpentine is not readily obtainable, it may be dispensed with. Care must be taken in either case that the mixture does not take fire. When the mass has cooled, it will become hard and brittle and it will then be ready for use. This constitutes the sole of the device. A lid may be made by obtaining from the tinners a disk of tin cut half an inch smaller all around than the resin sole. A stick of sealing wax forms a good handle. The lid may be made of a disk of wood covered with tinfoil, and a handle may be



PRODUCING THE SPARK IN THE ANTENNA.

made by attaching to the center of the wood a heavy piece of wire covered with rubber tubing. Either of the former makes a satisfactory lid.

Used as a wireless telegraph transmitter, the aerial or suspended wire should be attached to the metal plate of the lid in such a manner that when the plate is charged, the wire will not touch the sole. The wire leading to the earth or metal plate on the floor should have its upper end attached to a table, wall, or any convenient place, so that the charged lid carrying the aerial wire may be held closely to it, when a spark will pass between the edge of the tin disk and the end of the lower wire, as shown in one of our views. There will then be set up in it and the aerial wire a series of strong electric oscillations, the energy of which will be damped out in the form of electric waves.

In order to charge the metal plate, the resin disk must first be excited by whisking or rubbing it with a piece of hot flannel or a silk pad. After the resin is well rubbed, the tin lid is placed upon it for a few seconds, and the finger occasionally touching it as shown.

Now, on lifting the lid, if the knuckle or wire leading to the earth or floor is presented to it, a spark will pass, showing that the plate was charged. If a receiver, such as either of those referred to, is set up at a little distance, even though the walls of a room or two intervene between it and the electrophorus transmitter, the instant the spark passes a characteristic click is heard in the telephone receiver.

In order to repeat the process, the lid will need to be recharged, and this will require merely the placing of it on the resin sole and removing it again, although the plate will have to be freshly excited occasionally if energetic sparks are to be produced. It will be readily seen that the electrophorus is in fee simple a miniature electric machine.

The theory of the apparatus is very simple. The resin when rubbed briskly is negatively electrified and the neutral electricity is divided into positive and negative charges. When the lid is resting on the resin the former is acted on inductively and not by direct contact, since the resin is a non-conductor, and touches the lid at only a few parts. When the lid is touched with the finger, the free negative electricity is dispersed through the body of the operator when, simultaneously, the positive charge of the sole is communicated to the lid, which with its attendant aerial wire will be positively electrified. The wire leading to the earth will be charged to the opposite sign, and the mutual attraction between the two results in a spark. By grounding the terminals of the sending and receiving instruments, a distance of several hundred feet should be easily obtainable.

The Camphor Industry of Japan.

One of the most interesting exhibits made by Japan at the late St. Louis Exposition, illustrating camphor and its by-products, was shown in the Forestry Building. This large collection formed a part of the Formosan government exhibit and represented a great national industry known as the camphor monopoly. By a provision of the law of 1903 the sale of camphor produced in Japan is monopolized by the government through a restriction of the sale of crude camphor and camphor oil.

Every part of a camphor tree, even to the leaves, contains camphor. The forests are not confined to Formosa alone, but are also found in Japan proper. With the extension of the industry the large areas of this tree have been greatly reduced, though replanting and cultivation are practised to a considerable extent, a tree requiring fifty years to attain a diameter of one foot. In Formosa, however, there is still an extensive supply of native forest growth, and many huge trees are to be found in regions still unexplored. The supply, therefore, is assured for years to come.

Camphor is found in the form of crystals in the wood tissues, and is separated from the crude oil by double distillation. From the first distillation is secured an oxidized product, camphogenotol, the principle of the camphor oils of commerce. The crude camphor is a dark-colored substance fusing at 170 deg. C.

Among the by-products may be mentioned crude camphor oil, which comes out simultaneously with the camphor; white oil, obtained by sublimating the crude oil, and used in the manufacture of soap. Red oil is also obtained from the crude camphor oil, as well as black oil, which is extensively used in the preparation of varnishes. A turpentine is secured from the white oil that is in great demand for medical and industrial purposes. From red oil is obtained the product known as saffrol, employed to a considerable extent in the manufacture of perfumery, and also soap; and a disinfectant is also distilled from red oil, after the addition of other substances, claimed to kill the cholera bacillus. Another product is an insecticide, which when mingled with 100 parts of water, destroys insects injurious to farm crops.

The camphor products are: Refined granular camphor obtained by sublimation from crude camphor, price in Tokyo, yen 0.85, about 40 cents per pound; refined camphor, sublimed and compressed, worth one yen per pound; and refined camphor tablets, of Fujisawa camphor, obtained from crude camphor, worth yen 1.70 per pound.

The annual export of camphor from Japan is about 6,000,000 pounds, three-fourths of which is produced in Formosa, the other fourth coming from Japan proper, chiefly from Kyushu and Shikoku. The superior jury at the St. Louis Exposition awarded the Japanese camphor exhibit a grand gold medal.

SALT MAKING ON SAN FRANCISCO BAY.

BY ENOS BROWN.

The great natural deposits of rock salt found in various localities in the vast region west of the Rocky Mountains, are not, commercially speaking, of any particular value, owing generally to their remoteness from distributing markets and, necessarily, to the high cost of transportation. Except for a small local demand from ranchers the yield of these deposits is too minute to figure in general statistical records.

The vast amount of salt consumed on the Pacific Coast is derived therefore from the sea by evaporation in quantity only limited by the demand. The cost of evaporated salt is but one-fifth of the lowest rate of transportation on rock salt from the nearest source of supply to the most accessible ocean port.

The locality which enjoys a practical monopoly of salt making on the Pacific Coast of the United States is Alvarado, a town of Alameda County and 20 miles from San Francisco. At this point, which lies on the east side of the southern extension of San Francisco Bay, exist certain peculiarities in the lay of the land which, united with climate and a favorable character of the soil, combined to make the locality especially adapted for this particular industry.

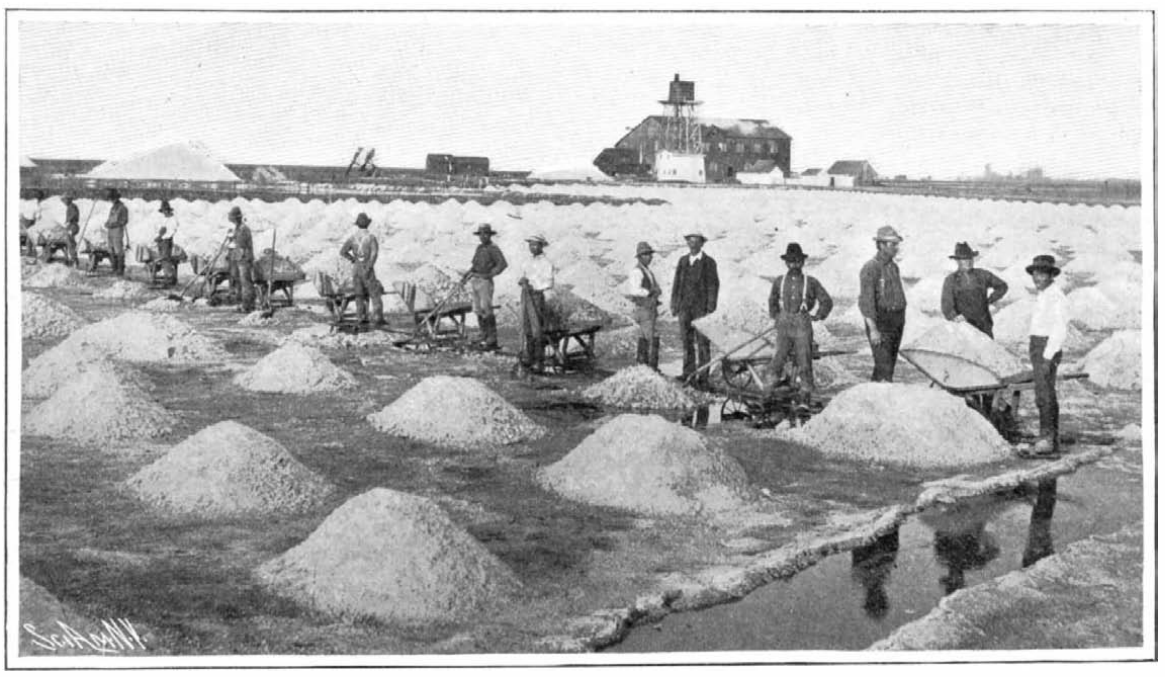
Long intervals of cloudless skies, the low humidity, and high temperature all favor rapid evaporation, while the soil, a stiff clay, is well adapted for levees and making water-tight reservoirs. The land would be submerged at high tide but for the levees that prevent. The highest point in all this tract of 1,000 acres, two miles from mean tide level, is not more than four feet, the low altitude allowing the reservoirs, for the most part, to fill with sea water by gravity alone. Moreover, the southern section of the bay is contaminated by no considerable affluents to dilute with supplies of fresh water the saltness which comes in with the tides of ocean.

The largest as well as most thoroughly equipped of the several corporations engaged in the business is the Continental Salt Manufacturing Company, which has thirty reservoirs covering 1,000 acres. This company has constructed from first to last 12 miles of levees, 2,600 feet of flumes and 7½ miles of ditches. A slough meanders through the tract, which is navigable for vessels of considerable draft and affords excellent and economical facilities for shipping.

A large mill, well equipped with the best machinery for washing, drying, grinding, sifting, and bolting the finished product is a prominent feature of the works. Twenty Dutch windmills and two Chinese pumps raise altogether 200,000 gallons of brine each minute. The entire plant presents to the observer a miniature Netherlands with the distant ships on the bay appearing as though floating in the air. The transformation of this low, half-drowned district, covered for the most part with a dense growth of swamp vegetation, has been effected by a large expenditure of time, labor and money. To eliminate the vegetation requires three years' time. First the levees have to be built and the inclosed land kept flooded for thirty-six months, when the plants die to the roots and the trace of iron left in the soil is washed out. Afterward the bottom of the new reservoir is first leveled and then made tight by heavy rollers being drawn over the surface, securing a strong and firm foundation. Flumes, sluices, and ditches to connect with other reservoirs are then constructed and the new inclosure is ready for salt making. The manufacture of salt from ocean water is a constant progression from one reservoir to another, transfer being made as the brine reaches a certain density to the next. Reservoir No. 1 covers 305 acres and is surrounded by a 4-foot levee. Its outward boundary is upon a slough flowing from the bay. As the tide rises, twelve gates are opened and allow the sea water to flow in to a depth of 3 feet. The gates are then closed. The average strength of the sea water is from 4 to 7 deg. and remains in reservoir No. 1 until the strength increases to 30 deg. By means of windmills reservoir No. 1 is emptied into reservoir No. 2 and the brine is exposed to the heat of the sun until it reaches a density of 50 to 60 deg., which may take three weeks. The brine is then pumped into reservoir No. 3, where it attains a strength of 75 to 80 deg. It then goes into reservoirs Nos. 4, 5, 6, 7, and 8, known as settling ponds, where the brine voluntarily parts with the lime which it contains and becomes almost a saturated solution at a strength of 90 deg. It is then conveyed to the twenty-two salt ponds where it is exposed to the fierce heat of the sun, and in about twenty days the salt is deposited and the pickle allowed to run off. Two crops are gathered, one each in August and October. After precipitation the salt remains exposed for a few days, when it is first piled in heaps and then wheeled in barrows into great pyramids on the banks. Boards are laid upon the bottom of the reservoirs to prevent the ground from being cut up by the wheels. Dump cars running on temporary tracks are also employed. After the salt is removed the reservoir is carefully cleaned of all surplus dirt and the bottom passed over by heavy rolls to harden the soil and prevent percolation. It is then ready for the next operation. The pyramids of crude salt remain on the bank exposed to the weather until it is shipped as "crude" or passes into the mill to be refined. The demand from tanners is supplied from the lowest grade. The first operation is the washing, by jets of water thrown against the cubes of salt as they pass from a hopper to the upper story of the mill, whereby all visible impurities are removed and leaving the salt, after it is dried, white and ready to be ground into assorted grades.

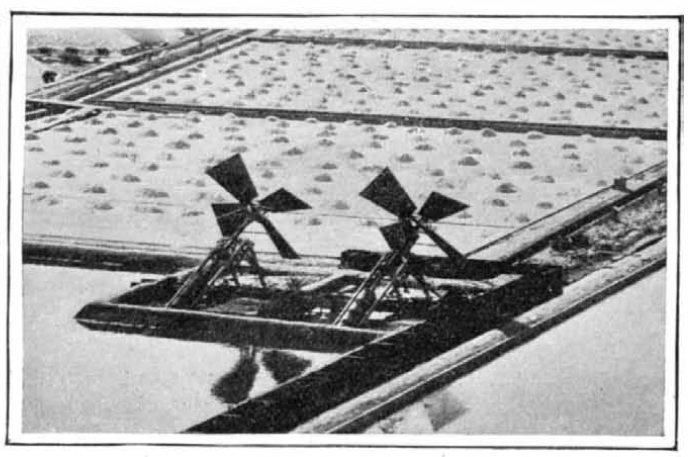
This process is not dissimilar in its methods to the manipulation of wheat as made into flour. The small remnant of lime, magnesia, and potash is eliminated from the salt crystals by air suction. The salt, when it emerges from the various processes, is of a purity of 98 to 99 per cent.

Levee making, inclosing new ponds, is proceeding at all times. A ditch 12 inches deep is first excavated, and a dirt wall 4 feet wide, built of cubes of clay sod and mortared together by

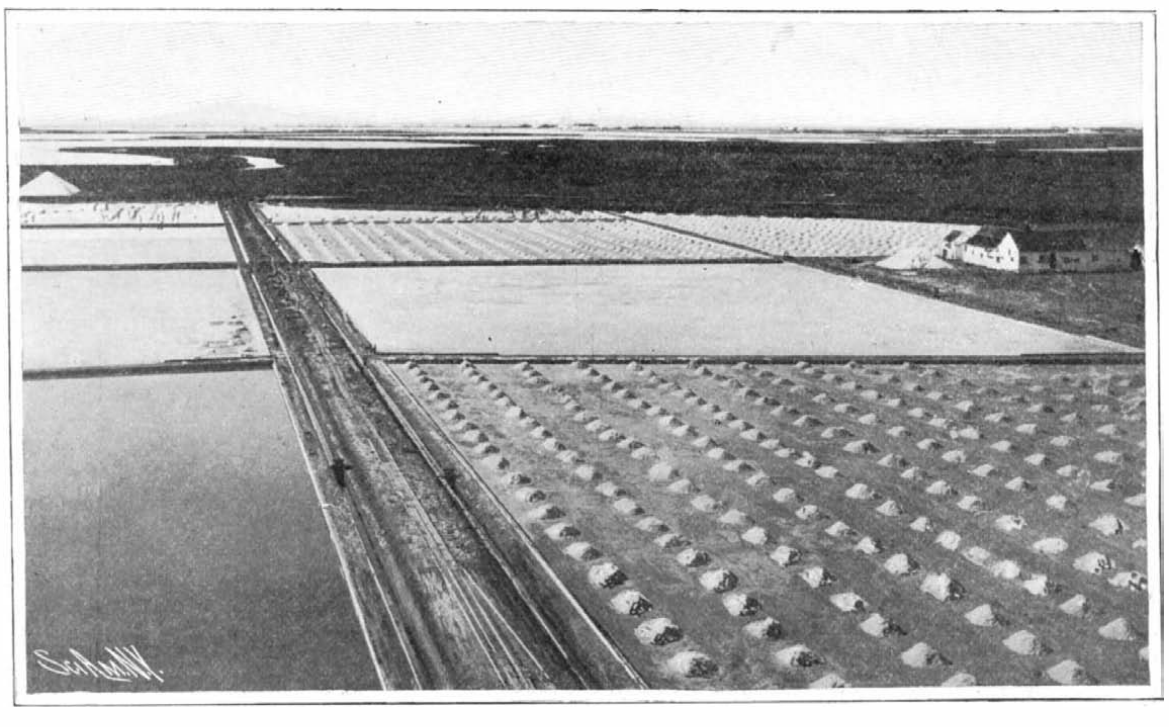


Gathering Salt From Settling Pond.

Scraping Salt From Hollow Settling Basin.



Windmills Raising Brine.



A General View of the Salt Fields.

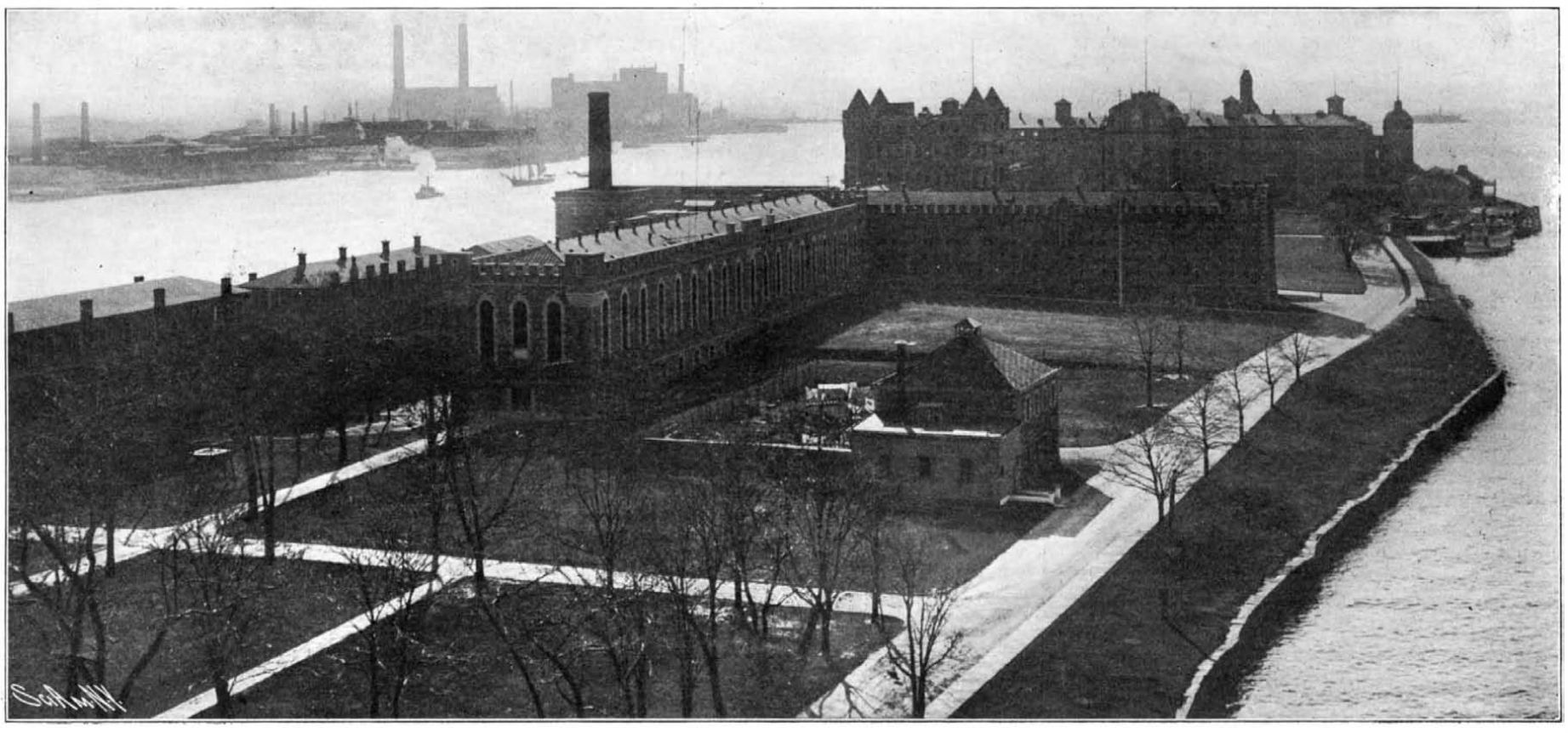
SALT MAKING ON SAN FRANCISCO BAY.

Pier on the Long Island Waterfront Looking Toward Blackwell's Island.

Constructing the Electric Gantry Crane for Erecting Blackwell's Island Span.

Pier on Westerly Shore of Blackwell's Island.

Inshore Pier on Long Island.



View Looking South From the Top of One of the Island Piers.

CONSTRUCTION OF THE BLACKWELL'S ISLAND BRIDGE OVER THE EAST RIVER.—[See next page.]

wet earth, is built to a height of 4 feet. Well constructed, the levees last indefinitely. In time vegetation springs from the outside of the adobe, and its verdure adds to the picturesque aspect of the place.

THE BAROSSA DAM, SOUTHERN AUSTRALIA.

BY EMILE GUARINI.

The dam recently finished at Barossa, near Gawler, in Southern Australia, is entirely of concrete and the largest of the kind that exists in Australia. This gigantic work, which presents peculiarities other than that of its dimensions, was constructed under the supervision of Alex. B. Moncrieff as chief engineer.

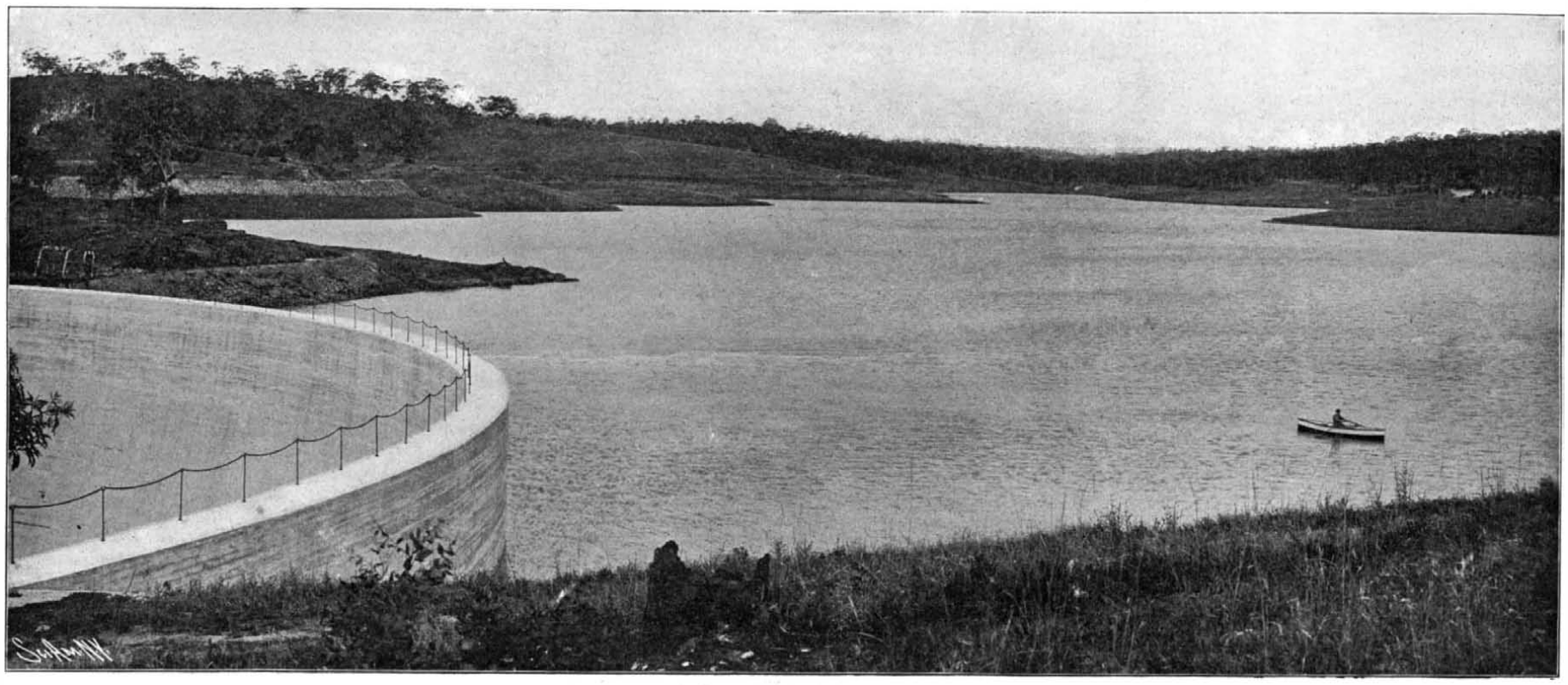
The site of the dam was selected at a point at which one of the banks presented a nearly perpendicular cliff 98 feet high, and at which the opposite bank, of an easy slope, formed a sort of spur, that projected into the bed of the river.

The dam is constructed entirely of concrete without any facing of dressed stone or rubble. Nevertheless, blocks of undressed gneiss were placed in the concrete, with intervals between them of at least six inches. At about 14¾ feet from the top of the dam, such blocks ceased to be employed because of the slight thickness of the dam at this part, and rows of curved rails, connected by fish plates, were imbedded in the concrete. A total weight of 40 tons of rails was worked into the dam in this manner. The dam is of the curved type, presenting its convex face to the water. The vertical section of the dam is triangular. The upstream facing is vertical and the downstream inclined. The height is 95 feet above the old level of the river. The thickness is but 36 feet at the base of the foundation in the thickest part, and 4.5 at the top. It was at a time. The mixture was made by weight and automatically. Before the composition of the concrete for one part or another of the dam was decided upon, experiments were always made in order to make sure of the impermeability of the material to the pressure that it had to support. The sand and broken stones were carefully washed, and, as for the cement, that was well aerated previous to being employed. The concrete was mixed in quantities of 28 cubic feet at a time, and immediately deposited in layers upon the work, the beds being arranged in such a way that the surfaces of separation corresponding to each deposit, and forming of joints, as it were, of this sort of bond, never presented any continuity either in a vertical or a horizontal direction.

THE NEW BLACKWELL'S ISLAND BRIDGE.

In common with the other large bridges spanning the East River, the Blackwell's Island Bridge has had to pass through a period of preliminary investigation and futile financiering before it was finally taken hold of by the city, its plans definitely determined upon, and construction actually begun. The first franchise for a bridge at that point was granted to a private citizen in 1884, but fourteen years passed away before the final plans as drawn up by the Bridge Commissioner were adopted. The crossing extends from Manhattan Island on the blocks bounded by Avenues A and B, and by 59th and 60th Streets, and extends across the two channels of the East River and over Blackwell's Island to the Long Island shore.

As originally planned, the structure was to consist of a cantilever bridge of five spans on four piers, one pier on the Manhattan shore, two intermediate piers nal lines throughout the whole length of the bridge, will be worked in a series of parallel plate-steel stringers, fifteen in all, and above these stringers will be placed a continuous steel buckle-plate floor. On the main floor of the bridge provision will be made for four trolley tracks, two on the inside of, and immediately adjoining, the trusses for the use of the overhead trolley cars, and two, as above mentioned, on the outside of the trusses for the use of the underground trolley cars. Between the overhead trolley tracks between the main trusses will be a broad roadway for vehicles having a clear width of 36 feet. This arrangement of the vehicle roadway is something new in New York bridges, where hitherto they have been separate, and placed on opposite sides of the axis of the bridge. The new method will have the advantage of providing a very broad and impressive thoroughfare, that will add greatly to the sense of spaciousness and dignity in this structure. At a height of 15 feet above the main floor of the bridge will be a second floor or deck, supported on transverse floor beams, which will be attached to the vertical posts of the bridge at each panel-point, the connection being stiffened by knees worked in below the point of attachment. On this upper deck provision will be made for two foot walks, each 11 feet wide and placed immediately next to the main trusses, and between them will be two tracks for the use of the cars of the elevated railways. Each tower will consist of a pair of massive legs of a general box section, each leg being battered to give greater lateral stability against wind pressure. The two legs of the tower will be heavily sway-braced, and at the top of the towers they will be connected by a deep latticed truss, and by an arch designed to harmonize from



View Along the Crest Showing Curved Form of the Dam.

THE CURVED CONCRETE DAM AT BAROSSA, SOUTH AUSTRALIA.

possible to make the dam of such slight thickness owing to the curved form that was given it in the plan and which gives to the structure all the resisting qualities of the arch. In plan, the curve of the upstream face is struck on a radius of 200 feet, over an angle of 135 deg. 20 min. and through an arc of 470 feet. The cost of the work ($849,400) is relatively very low, and, thanks to the reduction in thickness and the arched form, it is very much less than that of a dam having a profile sufficiently thick to resist the thrust of the water by its mass alone. The cost of such a dam was at first estimated at $1,145,800.

After the work was completed, the total cubical contents of the dam was estimated by precise methods, and was found to be exactly equal to that deduced from the weight of the materials that entered into the construction.

Since the dam was put in service, an observation made during six days, in which the temperature varied by 31 deg., has shown that, with such variation, the pitch increases by 0.8 of an inch, corresponding to a 1½-inch elongation of the arc. During the construction the temperature varied from —2 deg. to +55 deg. During the time of frosts, the masonry was covered with straw matting and fire was kindled that produced much smoke at the top of the masonry, doubtless to prevent the loss of heat by radiation. In this way the newly-laid concrete was very efficiently protected against the cold. The intention was to fill the reservoir in measure as the construction proceeded; but the irregular risings of the water of the river did not permit of this.

The concrete employed in the work was always mixed with the greatest care and in small quantities on the shores of Blackwell's Island, and the fourth pier on the Long Island shore. Ground was broken in September, 1901, but the work was carried along with such indifferent speed that by January, 1902, only $42,000 had been expended. At that time the plans of the superstructure were revised by the Bridge Commissioner and drawn up on the following dimensions: First, starting from the Manhattan side, there is a shore span of the main cantilever, 469 feet 6 inches in length; then the main river span 1,182 feet in length; next is the span across Blackwell's Island, 630 feet in length; then follow the span over the easterly channel, 984 feet long, and the Long Island shore span, 459 feet long.

From the above dimensions it will be seen that the Blackwell's Island Bridge will include one of the longest cantilevers in existence, the well-known Forth Bridge being the most notable of this type of structure, with two main cantilever spans, each 1,710 feet in length. The superstructure consists of two lines of trusses spaced 60 feet from center to center. The top chord is built up of nickel-steel eye-bars which vary in depth from 12 inches to 8 inches, according to the stresses that have to be provided for in any given section of the bridge. The bottom chord will be of the regular box construction of the kind that is now universally used for compression members in long-span bridges of this type. The floor system will be supported upon massive transverse floor beams, which will be carried out for a distance of 13 feet beyond the main trusses to provide a roadway for two lines of trolley cars, one on each side of the bridge, these extensions forming cantilever or bracket supports for such roadways. Between the floor beams, running in longitudian architectural point of view with the general construction of the whole bridge.

Considerable interest attaches to the eye-bars, inasmuch as they are of the same type as the much-debated eye-bars designed by the late Bridge Commissioner for the new Manhattan Bridge. They are to have an ultimate strength, annealed, of 90,000 pounds to the square inch, an elastic limit of 54,000 pounds to the square inch, and an elongation of 13 per cent in 8 inches with 35 per cent reduction of area. The great toughness of the material is shown by the severe tests to which it will be subjected. Thus an annealed test piece 4 inches wide or more must be bent cold through 180 degrees, around a pin whose diameter is twice the thickness of the test piece; while the unannealed specimen must bend through 180 degrees, around a pin whose diameter is three times the thickness of the test piece; and this must be done without any fracture appearing in the metal.

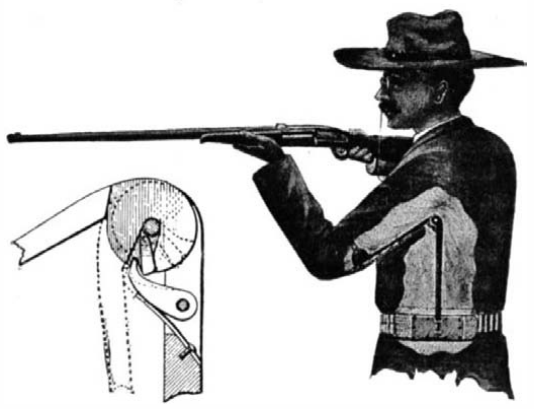
This fine structure, in addition to carrying the load due to its own weight, will have to support a live load of 6,300 pounds per foot run of the bridge, this being considered as the ordinary traffic; and it must also carry 12,500 pounds as congested traffic. The floor beams, moreover, will be dimensioned to meet the stresses of unusually heavy concentrated loads. The loading assumed for the foot walks is a maximum of 100 pounds per square foot.

The accompanying illustrations show the character of the masonry piers. These are of a simple and massive design, well suited to the character of a bridge of these monumental proportions. They are faced with dressed granite, and will harmonize well with the finished steelwork of the trusses.

Patent Department

ARM REST FOR RIFLEMEN.

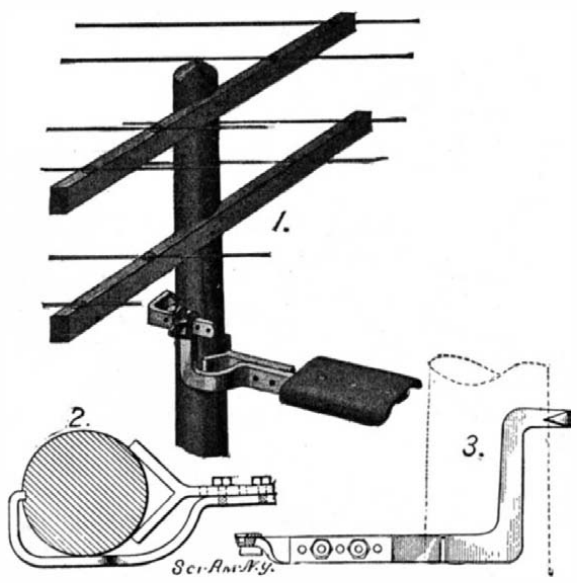
A recent invention provides a support for riflemen to insure steadier aim and greater accuracy. The supporter is strapped to the person and comes automatically into position when the arm is raised. At the same time it allows perfect freedom of movement laterally. As pictured in the accompanying engravings, the device comprises a post journaled at its lower end in bearings attached to a strap which is fastened around the waist of the user. The upper end of the post, which comes well up to the armpit, is forked to receive the heel of a bar pivoted therein. The outer end of the bar carries a curved plate and forms a rest for the rifleman's arm to which it is strapped. When the rifleman raises his arm the bar is swung upward with it and then held in extended position by a spring-pressed pawl pivoted to the post and engaging a notch in the heel of the bar. In one face of the heel a depression is formed to receive a fly, loosely pivoted therein. The outer end of the fly is tapered to a point which extends slightly beyond the periphery of the heel. To return the support to folded position it is merely necessary to raise the arm a little further until the pawl passes out of the notch and over the end of the fly, so that on lowering the arm, the pawl will first push the fly forward and then ride on its tapered edge over the notch, permitting the bar to swing down. As the post is mounted to turn in bearings upon the waist strap, it is evident that the rifleman may freely swing his arm laterally, whether the support be extended or folded. The arm rest may be adjusted to any desired angle by changing the position of the notch in the heel. At an angle of 90 degrees it would make an excellent support for pistol shooting. Mr. William S. Dunham, of Sharpsville, Pa., has secured a patent on this novel arm rest.



ARM REST FOR RIFLEMEN.

LINEMAN'S SUPPORT.

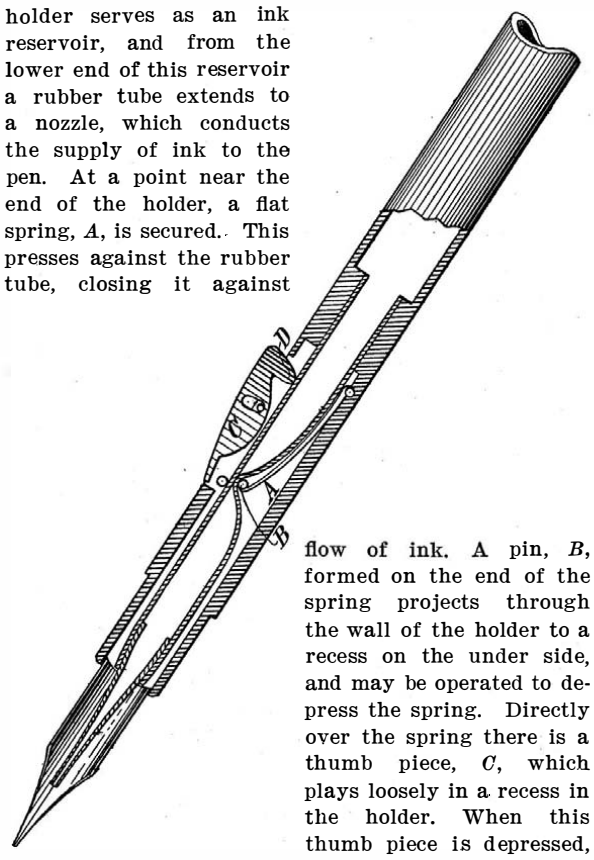
A very simple support for the use of linemen while at work on poles has been provided by the recent invention of Mr. Robert G. Johnson, of Clearmont, Mo. As shown in the accompanying illustration, the device comprises a main bar which, at one end, carries a seat and at the other an upwardly-extending arm. This arm at its outer end is curved to encircle a pole, and terminates in a sharp projection adapted to sink into the wood at the rear of the pole. The forward side of the pole is engaged by the branches of a Y-shaped member, which is secured with two bolts to the main bar. The Y-shaped member is provided with a number of bolt holes, through any pair of which the bolts may be passed to adjust the device to different sizes of poles. The use of the device will be evident from the drawing. The lineman tilts the seat end of the support upward, places the sharpened projection against the rear of the pole, and then brings the Y member into contact with the opposite side. Owing to the fact that the points of contact on opposite sides of the pole are not in horizontal alignment, it will be evident that any weight placed on the seat of the device will cause the support to turn on the Y member as a fulcrum and sink the sharpened projection deeper into the wood. Thus, a secure support is provided for the lineman. If the pole is of small diameter, it may be necessary to adjust the Y member further forward on the main bar, else the seat will be tipped to an inconvenient or unsafe angle. The inventor has also designed an improved form, which we illustrate in Fig. 1. This is provided with an adjustable hook, which is held with a single thumbscrew. This can evidently be more easily adjusted than the bolted Y member. It will be seen that the scaffold is comparatively inexpensive to construct, and while amply strong is so light that it may be readily carried by the user. It is also applicable to many other purposes than its use by linemen, such as that of carpenters in connection with pole barns, and also as a support for stagings.



LINEMAN'S SUPPORT.

AN INK-CONTROLLED FOUNTAIN DRAWING AND WRITING PEN.

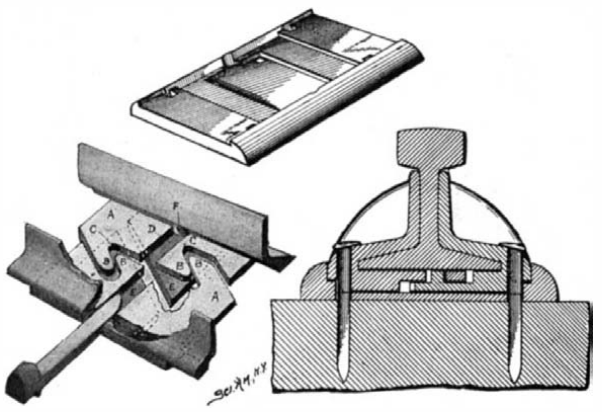
A new type of fountain pen has recently been introduced by Mr. Louis Winter, of 900 Centre Avenue, Reading, Pa. This pen differs very materially from the usual type of fountain pen, which depends upon gravity to produce a flow of the ink. As shown in the accompanying illustration, the hollow handle of the penholder serves as an ink reservoir, and from the lower end of this reservoir a rubber tube extends to a nozzle, which conducts the supply of ink to the pen. At a point near the end of the holder, a flat spring, *A*, is secured. This presses against the rubber tube, closing it against flow of ink. A pin, *B*, formed on the end of the spring projects through the wall of the holder to a recess on the under side, and may be operated to depress the spring. Directly over the spring there is a thumb piece, *C*, which plays loosely in a recess in the holder. When this thumb piece is depressed, the rubber tube is first closed by the projection, *D*, at a point above the spring closure, and then as the forward end of the thumb piece continues to descend, the ink imprisoned between these two closures is squeezed past the spring into the nozzle. The thumb piece is in such position that it may be conveniently operated by the writer as desired. Since the reservoir is air-tght, a partial vacuum is produced therein every time the thumb piece is operated; and after the writing is done, the pin, *B*, is operated to depress the spring, *A*, when this vacuum will cause the ink to be sucked up from the pen, leaving the nozzle and pen clean and dry while not in use. Any kind of a pen may be fitted into this holder, and the life of the pen will be longer than ordinary, because only one side is inked and no ink remains on the pen after use to corrode it. In the drawing pen the nozzle leads down between the bows to near the points. As the ink may be sucked up after use, there will be little danger of the drawing ink gumming and clogging the pen.



AN INK-CONTROLLED FOUNTAIN DRAWING AND WRITING PEN.

RAIL-JOINT CONNECTION.

In the accompanying engraving we illustrate a novel form of rail-joint connection invented by Mr. Joseph Graff, of Calmar, Iowa. The purpose of this construction is to provide a very secure clamping device which will, at the same time, permit longitudinal expansion and contraction of the rails due to changes of temperature. Two similar clamping plates are used which are locked together by a key, and both key and clamping plates are then held in a shoe which prevents the key from slipping out and provides a substantial base for the rail joint. Each clamping plate is formed to fit over the base flanges and against the webs of the two meeting rails. It is also provided with a flange, *A*, adapted to extend under the rails. The inner edge of this flange is formed with tongues, *B*, and notches, *C*, diagonally disposed, and a central slot, *D*. A plate, *E*, formed integrally with this flange provides a bottom for one of the notches and for the central slot. The arrangement is such that the flanges of a pair of clamping plates, embracing opposite sides of two meeting rails, will interlock. This engagement is effected by moving the clamping plates toward each other along the rails until the slots, *D*, are brought into alinement.

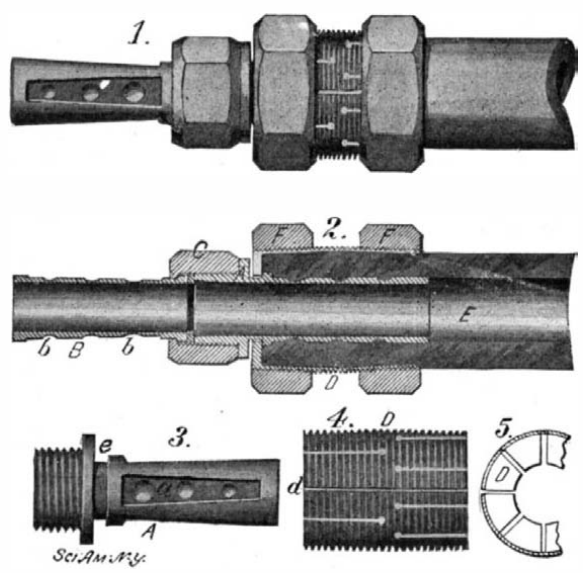


RAIL-JOINT CONNECTION.

To prevent the plates from spreading apart, a flat bar or key is inserted through the slots, *D*. The shoe is formed with side flanges adapted to engage the outer edges of the clamping plates. Recesses are formed in the face of the shoe to receive the flanges, *A*, and plate, *E*. The parts are secured to the ties by spikes driven therein, and passing through the clamping plates and the shoe. The corners of the base flanges of the rails are cut off, forming V-shaped notches at the meeting ends, into which lugs, *F*, on the clamping plates project. These serve to prevent creeping of the rails.

HOSE COUPLING.

Pictured in the accompanying engraving is a hose coupling, which can be readily operated to lock both the exterior and the interior of the hose against disengagement. The construction will be best understood by reference to Fig. 2, which is a cross section of the device. Two tubular coupling members, *A* and *B*, are employed, which are adapted to fit into the interior of the hose. Four flattened faces, *a*, are formed on the outer surface of each member. These faces are inclined toward the inner ends of the two members, and each face is formed with depressions, *b*. The member, *A*, as shown best in Fig. 3, differs from the member, *B*, in having at the inner end a wide flange and a threaded shank. This receives the coupling nut, *C*, which serves to draw the two coupling members together in the usual way. The hose, *E*, is attached to the coupling member, *A*, by means of a compressible sleeve, *D*, and a pair of nuts, *F*, threaded onto the sleeve. This sleeve, as shown in Figs. 4 and 5, is divided longitudinally at *d*, which permits the inwardly-projecting flange at the end of the sleeve to be sprung into the depression, *e*, on the member, *A*. The sleeve is also provided with saw slots at each end to permit contraction. In use the hose is fitted into the annular space between the sleeve and the coupling member, *A*. Then the nuts, *F*, which have a tapered bore, are threaded onto the sleeve, contracting the latter and pressing the hose against the faces, *a*, and into the depressions, *b*. The sleeve, *D*, owing to the slots in the ends, will be compressed more at the ends than at the center, causing the outer surface of the hose to be arched, and, as the sleeve is held to the member, *A*, by its flange entering the depression, *e*, it will be evident that the outer surface as well as the inner surface of the hose will be firmly locked in place. Mr. William



HOSE COUPLING.

H. Albee, of 101 Pearl Street, New York city, is the inventor of this hose coupling.

RAILWAY GAGE.

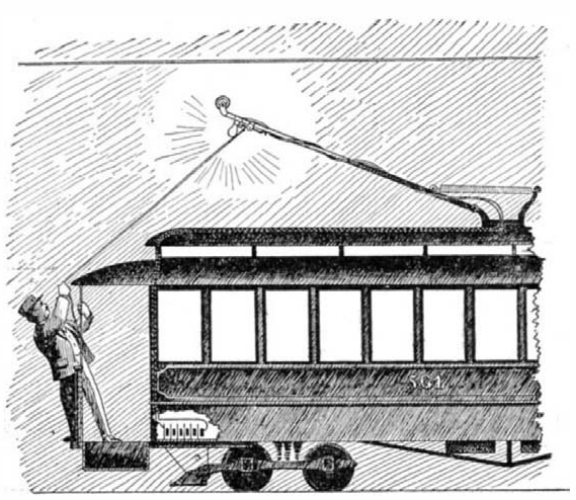
The method now ordinarily used in railway construction for bringing rails to gage is rather crude. Spikes

RAILWAY GAGE.

are driven into the ties against the base flanges and crowded either inward or outward to press the rail to proper position. This often results in bending the spikes or in breaking the upper faces of the ties in such manner as to permit water to percolate through to the interior, causing decay of the tie and thus increasing the expense of maintenance. We show herewith a device that greatly simplifies the process of gaging a railway and which avoids the difficulties above noted. The device comprises a drawbar, provided at its outer end with a head, and to the other end the shorter arm of a bell crank lever is pivoted. At the angle of the bell crank lever a claw is hinged. The claw is provided with a head at its outer end. In use, this head and that on the rod are slipped over opposite rails and the bell crank is then operated to draw them together. To prevent the rails from moving in too far, a spreader is provided which comprises a tube or sleeve loosely mounted on the rod. At the end adjacent to the bell crank lever a yoke is attached to the sleeve, and this yoke, at its outer end, is formed with an abutment. An abutment is also carried on the other end of the sleeve, and these are adapted to press against the inner faces of opposite rails. The yoked member serves not only to span the bell crank lever joint, but also to brace the gage laterally and insure its lying squarely across the track. A patent on this railway gage has been granted to Mr. Robert M. Jenkins, of Carney, Ala.

ODDITIES IN INVENTION.

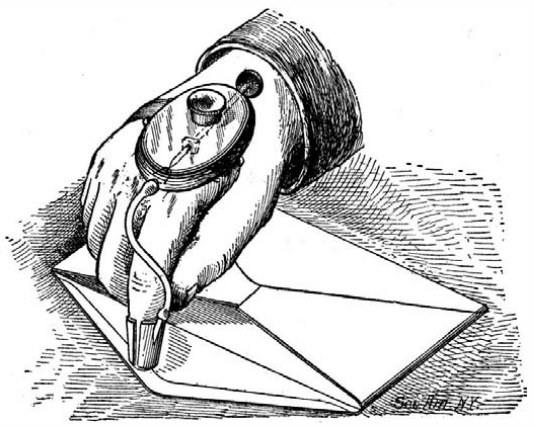
Trolley Light.—Evidently the trolley problem has not been solved yet; for the United States Patent Office is still crowded with applications for patents on trolley guards, and the like. But a Western inventor has apparently given up the idea that trolley wheels can be made to stick to the wire, and has endeavored instead merely to alleviate the trouble by providing an electric light near the end of the pole to assist the conductor in replacing the trolley at night. The electric lamp is lighted by a battery located in the body of the car. A switch is interposed in the circuit near the lamp, and to one end of this switch the trolley rope



TROLLEY LAMP.

is attached. Normally this switch is held open by a spring; but when the conductor pulls the rope to draw down and replace the trolley, the switch is closed, lighting the lamp, and thereby facilitating the work of placing the wheel in proper contact with the wire. Connected in series with the trolley lamp, are a number of lamps in the car which serve to illumine the same while the trolley is being replaced.

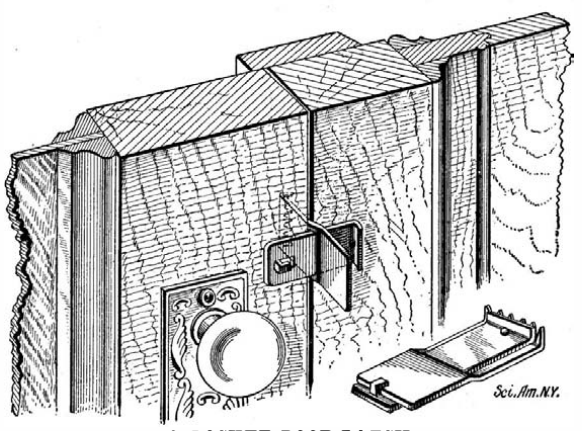
Device for Moistening Gummed Surfaces.—The evils of moistening stamps and envelope flaps, particularly in large quantities, with the tongue are too well known to require description here. The accompanying engraving illustrates a rather clever device for avoiding this disagreeable and unsanitary practice. Strapped to the back of the hand is a water reservoir, from



DEVICE FOR MOISTENING GUMMED SURFACES.

which a tube leads down to a thimble on the first finger. The flow of water in the tube is controlled by a needle valve operated by a thumbscrew at the upper end of the reservoir. The water is taken up by a suitable absorbent material on the thimble. Capillary attraction, as well as the force of the water falling through the tube, insures a steady feed to the thimble, which serves as an ever-moist finger for moistening the gummed surfaces.

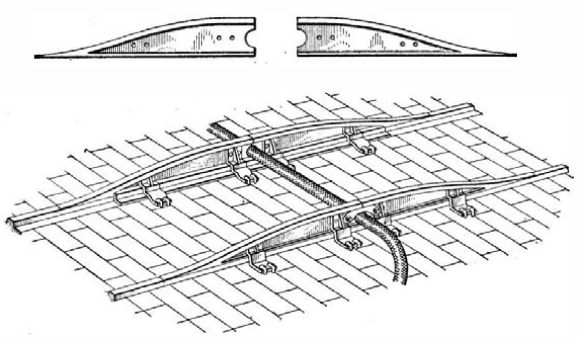
A Pocket Door-Latch.—A simple little pocket device has recently been invented, which may be applied to a door to secure it in closed position. The device consists of a bolt and a jaw member. The latter is formed with teeth at one end adapted to be sunk into the door jamb. The other or projecting end is formed



A POCKET DOOR-LATCH.

with a slot to receive the bolt, which may be operated in the usual way to bolt the door shut. Our illustration shows how the device may be folded so that it can be readily carried in the pocket. This little latch will be found very useful for traveling men, who are often obliged to spend the night in suspicious and even dangerous lodgings.

Fire-Hose Protection for Car Tracks.—The stoppage of street cars in time of fire, due to stretching the fire hose across the car tracks, is a matter of great annoyance, if not expense, to the passengers. This is sometimes avoided by elevating the hose sufficiently to permit cars to pass under it. A simpler arrangement is to elevate the track over the hose, as indicated herewith. An auxiliary track is provided, consisting of two pairs of abutting rails, in which openings are



FIRE-HOSE PROTECTION FOR CAR TRACKS.

formed at the abutting ends to receive the hose. The rails when joined form an arch leading from the main track over the fire hose. Simple means are provided for clamping this auxiliary track in position.

Edward Dodd McCracken, who died at Leonia, N. J., on December 13, aged sixty-six years, was a genius of a rare type. His father was a paper maker, and the son was associated with him in that business for some time, during which period he was responsible for a great many improvements in paper-making machinery. When a young man he succeeded in getting the British government interested in the construction of paper mills at Kingston, Jamaica, for the manufacture of paper from wood fiber. Returning to the United States, he gave his attention to electrical matters, and at once took a foremost place among the workers in this field, winning medals and commendation from the American Institute Fair, S. F. B. Morse, and the British government. In 1884 he was awarded a patent on paper insulation for electrical wires, and engaged in the manufacture of it, which developed into a very extensive business. For a long time this wire was used exclusively in the conduits carrying wires under the city streets.

THE NEW TRADE MARK LAW.*

Some weeks ago we published in the Scientific American an article by Mr. A. P. Greeley upon the new trade mark act, which since that time has become a law and will go into effect on April 1, 1905.

The various advantages of the new act were pretty well set forth in this article by Mr. Greeley, who has been so intimately identified with the enactment of the new law.

He has recently published a brochure on the new act, which sets forth the brief history of the legislation leading to the enactment of the new law, with a statement of the various bills which have been presented to Congress during the past few years, but which failed of passage. The advantages derived from registration have now become so great, that it is evident manufacturers will make exclusive use of the new privileges under the act. The largely increased damages which it is possible to obtain for infringement of trade mark under the statute render registration desirable, as it is possible to obtain recovery to the amount of three times the damage done. Furthermore, in case registration is refused and an appeal is taken from the decision of the Examiner, it may then be carried to the Commissioner of Patents, and from there it may be carried to the Court of Appeals for the District of Columbia, a most desirable procedure.

Under the new law it is possible, under certain conditions, to obtain registration for marks of a non-technical character, which would not have been permitted to be registered under the law of 1881. This is a very important feature of the new act.

Under the provisions of the new act it will be possible to register the trade mark actually used, and it will not be required to restrict the application to particular features, so that the question of infringement will be, as under common law, a question whether the alleged infringing mark so far resembles the trade mark used by the registrant as to deceive purchasers.

We quote the following: "But while the new act does not *compel* registration of unregistered marks, and does not *compel* re-registration of marks previously registered, the provisions of the new act are such that the owners of unregistered trade marks entitled to registration under the *new* act will find that the advantages resulting from registration will be so important that they cannot afford to fail to register, and the owners of trade marks registered under the act of 1881 will probably find it worth while to re-register under the new act for the sake of securing the additional remedies against infringers given by the new act; though, unless they consider these additional remedies given by the new act necessary for the protection of their rights against infringers, there is no need to re-register, as the certificates of registration issued to them under the act of 1881 are still effective as record evidence of *prima facie* right to the registered marks and as sufficient evidence to compel the Patent Office to refuse to register the same mark to others."

Mr. Greeley points out another feature of the act, which is also of practical importance, namely, that it will now be possible for trade marks which have been refused registration under the old act to be revived; and as there is no provision of the new law under which an application for registration is held to be abandoned by failure to prosecute, it will be possible to renew the application for the registration of such marks without the payment of a further government fee. It appears that this provision will apply not only to pending applications, but to such as may have been rejected. One of the advantages that will be especially welcomed by the owners of trade marks will be reduction in the government fee for registrations from $25 to $10.

In summing up, Mr. Greeley makes the following statements:

"The new act thus, while not *compelling* registration in the sense of abrogating or lessening the common law right, makes it necessary for the owner of an unregistered mark to register it if he wishes to avoid the possible expense of overcoming the effect which may arise from its registration by another. In this sense the provisions of the new act respecting the publication of applications for opposition would seem to have an effect to make registration practically compulsory."

* Registration of Trade Marks under the New Trade Mark Act, by Arthur P. Greeley. John Byrne & Co., publishers, Washington, D. C. Price, 50 cents.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRICAL TROLLEY.—S. R. STODDARD, Glens Falls, N. Y. A shoe or traveling member is provided with contact mechanism movable relatively to it so that the weight of the shoe acting upon the contact mechanism, forces a conducting member into engagement with a contact surface of the rail. This contact surface preferably faces downward, being thereby protected from the weather and is also preferably insulated from the main body of the rail. The invention relates to electrical trolleys for general use, and more particularly to trolleys used in connection with so-called third-rail systems.

Of Interest to Farmers.

COTTON-PICKER.—J. M. SEARLES, Vicksburg, Miss. This machine is adapted to move through a cotton-field and to remove cotton from the plant, depositing the same in bags or receptacles carried by the apparatus. The invention comprises a wheeled frame adapted to straddle the cotton-rows and provided with traveling aprons, which pass at each side of the row, and peculiar picking-fingers by which the cotton is grasped and lifted to the upper part of the machine, where the cotton is disengaged from the pickers and falls into suitable receptacles provided for the cotton.

GATE.—J. W. ELLIOTT, South McAlester, Indian Ter. To open the gate either pendant may be pulled, this acting, through the flexible operating member, to first raise the latch-bracket above the end upon the supporting member. The gate released, the pull of the operating member swings it upon its trunnions, when the weight continues this movement until gate assumes vertical position. To close the gate, pendants are drawn in like manner, the impulse swinging the gate inwardly and downwardly against the weight, the angular end of bracket riding over the support until it falls by gravity and is there locked against opening stress of the weight and accidental raising by stock.

Of General Interest.

SKIN-STRETCHER.—A. W. ANDREWS, Winnebago City, Minn. In this case the invention appertains to improvements in devices for holding and stretching the skins of muskrats and similar small animals for the purpose of dressing and drying, the object being to provide a stretcher of simple construction that will be light, yet strong and serviceable, and having no parts liable to get out of order.

CALENDAR.—J. M. BIGGS, Glasgow, Ky. On an outer disk names of the days of the week appear, and at its inner rabbeted position it receives a second central disk divided at its edge into segments corresponding to the week days, each segment bearing members representing certain of the days of the month, arranged in sequence corresponding to each recurring week day, as 1, 8, 15, etc. The disks rotate to bring a week day into the corresponding days of the month. The invention is intended especially for pocket use and more particularly as an advertising novelty.

MEMORANDA ATTACHMENT FOR WATCHES.—W. W. WIKOFF, Maysville, Ky. This invention provides a simple memoranda attachment so fashioned as to be easily applied to any watch and which by the frequent references to the watch in determining the time of day directs the notice of the writer to his memoranda. The writer does not have to remember the fact that he has a memoranda as a condition precedent to reference thereto, but has it obtrusively thrust upon his attention every time the watch is consulted.

EXPANSIBLE REMINDER-RING.—C. T. WHITSETT, Indianapolis, Ind. In this case the invention refers to a ring having attached thereto a plate of suitable ornamental design upon which a legend adapted to serve as a reminder is so placed that it may be easily read by the wearer of the ring when the hand bearing the ring is held in natural position, thus adapting the ring to prevent forgetfulness of appointments, errands, etc., which the wearer desires to keep in mind.

AUTOMATIC AWNING ATTACHMENT.—A. I. SCHWINGER, New York, N. Y. The invention relates to an attachment for awnings and similar devices by means of which they can be spread out automatically upon certain changes in the weather. Although especially applicable to ordinary awnings, it can be applied to tent-covers, shades, and similar devices. The principal object is to provide automatic means for permitting devices of this character to be operated by a rise in temperature above a certain degree and also by a fall of rain or snow.

MOLD.—C. MILLER, Binghamton, N. Y. In this patent the invention has reference to a mold for forming rubber articles, particularly elastic rubber cores for cushion-tires. The invention resides in a peculiarly-formed mold-core which combined with the mold proper, enables the inventor to shape a cellular elastic tire-core.

MUFF.—W. GRUSHOFF, New York, N. Y. The aim of this inventor is to provide a muff in which the lining forms an integral part of the down-bed to permit the furrier to readily secure the fur or other cover in position and to hold the lining at all times properly stretched without danger of wrinkling up when placing hands into the muff, as is so frequently the case with the muff ordinarily constructed.

EXPANSION-BOLT.—F. H. EVANS, New York, N. Y. The object of this improvement is the provision of an expansion-bolt composed of comparatively few parts held together when not in use without separate fastening devices and arranged to insure a firm engagement and imbedding or gripping of the expanding devices in the wood, stone, or other material on which the bolt is used. Patents in this case have been applied for in England and other principal foreign countries.

DEVICE FOR FILLING FOUNTAIN-PENS.—G. N. BYL, Jersey City, N. J. The purpose in this improvement is to provide a device whereby fountain-pens may be directly filled from a vessel in which ink is contained, the rapidity of the feed being under absolute control of the operator. The vessel has a flexible suction top or cap carrying a conducting-tube, the cap being readily removed and applied. The cap is provided with a reinforcing-spring which tends to extend the life of the cap and prevents the latter from being accidentally forced suddenly downward and the pen-barrel consequently overflowed while being filled. Means are provided for holding a support for the tube in position in the cap.

Heating and Lighting.

WATER-HEATER.—W. E. KAY, Lorain, Ohio. The invention relates to a heater adapted for use in barber-shops, bath-rooms, and other places where it is required to heat water quickly and in considerable quantity. The apparatus is so constructed that the volume of the heating medium consumed and the consequent amount of heat developed and utilized is varied proportionate to the quantity of hot water drawn off for use, this being effected automatically by a new regulating valve mechanism and new form of burner.

Machines and Mechanical Devices.

HANDHOLD-SAWING MACHINE.—B. J. PYE, Astoria, Ore. This inventor's improvement has reference to wood-working machinery; and his object is the provision of a new handhold-sawing machine designed for quickly and accurately forming handholds or grooves in end boards for boxes or the like to permit of conveniently handling the box.

GOVERNOR.—H. KRONER, Baltimore, Md. The invention relates to a centrifugal governor adapted particularly for use in connection with turbines, but useful with various other machines. The prime object is to so arrange the centrifugally-actuated part or parts that the movement thereof will be attended by the least possible friction, thus increasing the sensibility of the governor, permitting it to respond effectually to any slight variations in the speed of the driving apparatus.

MACHINE FOR PRINTING CLOTHING-TICKETS.—A. ANTOINE, New York, N. Y. The purpose of the invention is to provide a form of machine capable of being manually operated and which will print on each ticket of a set or series the lot and the shade number, it being simply necessary to enter a series or strip of blank tickets in the machine, whereupon in operating the machine the tickets will be automatically printed in the desired sequence and fed out from the machine, the type on the printing-wheel of the machine being removable.

CYANID-AGITATOR.—E. STEVENS, Leadville, Col. The invention relates to ore-working machines and admits of general use, but is peculiarly applicable to working ores containing precious metals in connection with so-called cyanid-process. One of the more particular objects is to bring the pulp after thorough admixture into contact with the air in order to facilitate the chemical combination necessary for separating the gold or silver. Another is to thoroughly agglomerate materials and to give the same a gentle working, such as will place them in suitable condition for the cyanid to extract a comparatively large amount of the precious metals.

APPARATUS FOR HEATING TOOLS.—J. PIRIE, Montpelier, Vt. This improvement pertains to apparatus for heating stone-cutters' tools—such as points, chisels, hammers, drills, and the like—prior to sharpening the same. The object is to provide an apparatus arranged to enable a single operator to heat a large number of tools in a comparatively short time.

Railways and Their Accessories.

CABLE-TRAMWAY.—C. MESSICK, JR., Hackensack, N. J. One purpose of the invention is to provide a support for a tramway which is in the shape of an arch carried on a fulcrum located as near as possible to the top of the arch, which is placed beneath the track-cable and normally supports the cable at the central portion of the arch, whereby when a car approaches the arch one end is depressed, thus providing a gradual rise from the car as it approaches the supported arch and a gradual declivity as the car moves away from the arch.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of the paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 6658.—Wanted, information concerning cost of equipping a plant for electric lighting and power purposes, providing current enough for town of 25,000 or 30,000 inhabitants.

For mining engines. J. S. Mundy, Newark, N. J.

Inquiry No. 6659.—For manufacturers of machines run by electricity or otherwise, for sand-papering floors laid in place in a building.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 6660.—For manufacturers of accordion plaiting machines.

Perforated Metals, Harrington & King Perforating Co., Chicago.

Inquiry No. 6661.—For manufacturer of article called "squeeze it," marked patented November 23, 1903.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 6662.—Wanted, formula for making railroad torpedoes for placing on rail as a danger signal for approaching trains.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 6663.—For Eastern and Western manufacturers of barber's chairs, supplies and plate glass mirrors.

One-eighth horse power battery motors, $5 each. Walsh's Sons & Co., Newark, N. J.

Inquiry No. 6664.—Wanted, information of how to cane chairs.

Commercially pure nickel tube, manufactured by The Standard Welding Co., Cleveland, O.

Inquiry No. 6665.—For makers of small air pumps for use with an ordinary windmill for pumping air into a tank.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 6666.—For manufacturers of spoke-turning machines.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 6667.—For the best mixing vats, air compressors, washers, etc., for a dynamite plant.

WANTED.—Ideas of a mechanical or electrical nature to manufacture on royalty. Bartlett & Co., 138 Liberty Street, New York.

Inquiry No. 6668.—For the name and address of parties handling the McFarland D. Moore's system of lighting.

Gut strings for Lawn Tennis, Musical Instruments, and other purposes made by P. F. Turner, 46th Street and Packers Avenue, Chicago, Ill.

Inquiry No. 6669.—For makers of pasteboard mailing tubes; also leatherette articles, such as scissors and knife cases, for advertising purposes.

In buying or selling patents money may be saved and time gained by writing Chas. A. Scott, 719 Mutual Life Building, Buffalo, New York.

Inquiry No. 6670.—For manufacturers of knife-cut veneering, also of chair bottoms.

We Manufacture on Contract anything in light Hardware. Write us for estimates. Edmonds-Metzel Mfg. Co., 143-153 South Jefferson Street, Chicago.

Inquiry No. 6671.—For manufacturers of the best machinery for a cannery.

We manufacture iron and steel forgings, from twenty pounds to twenty-five tons. Crank shafts of all varieties. Erie Forge Company, Erie, Pa.

Inquiry No. 6672.—For manufacturers of machinery for making wood pulp.

The SCIENTIFIC AMERICAN SUPPLEMENT is publishing a practical series of illustrated articles on experimental electro-chemistry by N. Monroe Hopkins.

Inquiry No. 6673.—For makers of a machine for cracking cocoanuts and removing the kernel.

FOR SALE.—Patent for quick R. R. car loader and unloader, for bar iron and lumber, used every day. Price, $1,000. Address Gains Paddock, Sr., 1000 Spruce St., St. Louis.

Inquiry No. 6674.—Wanted, the name and address of the power and reducing company of Niagara Falls, or any other maker of stick phosphorus by modern methods.

Sheet metal, any kind, cut, formed any shape. Die making, wire forming, embossing, lettering, stamping, punching. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 6675.—For makers of power house combined clipping and grooming machines.

WANTED.—Colonial silverware. Any one wishing to sell any authentic silver made in this country during the eighteenth century, please communicate with C. A. M., Box 773, New York.

Inquiry No. 6676.—For manufacturers of a machine printing names for one cent.

VALUABLE PATENT FOR SALE.—An indispensable article for women. Has large demand in all department stores. Patent No. 774,191. Address Acme Hygienic Co., 132 West 90th Street, New York.

Inquiry No. 6677.—For makers of coin-operated, automatic banjos.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6678.—For makers of a crude olive oil filter; also for a machine to clean and improve the quality of raisins.

Space with power, heat, light and machinery, if desired, in a large New England manufacturing concern, having more room than is necessary for their business. Address Box No. 407, Providence, R. I.

Inquiry No. 6679.—Wanted, a pump for cleaning out a cess-pool, also a tank for carrying away the refuse.

You can rent a well equipped private laboratory by day, week or month from Electrical Testing Laboratories. 548 East 80th Street, New York. Absolute privacy. Ask for terms and facilities.

Inquiry No. 6680.—For an electrical apparatus for thawing out water pipes.

WANTED.—Articles to manufacture requiring heavy iron casting, where little or no machine work is involved. Will purchase or manufacture under royalty. Eureka Foundry Company, Rochester, N. Y.

Inquiry No. 6681.—For a pneumatic motor to operate a milking device; the motor to have a stroke of only about ¾ inch and speed of about 20 strokes per minute.

A Reliable Manufacturing Institution solicits the correspondence of parties desiring to sell patents of any *useful mechanical* article which could be manufactured and sold in conjunction with the Mill Supply and Belting business. F. Raniville Co., Pearl St., Grand Rapids, Mich.

Inquiry No. 6682.—For an electrical device to be used in ringing chime of bells in church tower.

Inquiry No. 6683.—For firms who make and construct roller coasters, merry-go-rounds, scenic railways, shoot-the-chutes, etc.

Inquiry No. 6684.—For information as to cost, size and cost of installation of ice plants, also probable cost of running same.

Inquiry No. 6685.—For a machine for making hooks and eyes.

Inquiry No. 6686.—Wanted, a design for a motor launch 16 to 17 feet long, 4 to 5 feet beam and about 20 inches deep midship; also set of drawings or set of castings for a 2 or 4-cycle gasoline engine 2 to 3 h. p., at 6 to 7 revolutions per minute; water cooled, and not weigh over 90 pounds.

Inquiry No. 6687.—Wanted, cheap bicycle bell, in 10,000 lots—plain bell without clamps or fastenings.

Inquiry No. 6688.—For spring wire made in Germany, known as Aiken or Eaken; also names of dealers in imported spring wire.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9589) W. F. asks: Would you please tell me what the liquid is, that is used in the instrument described in your issue of December 31, 1904, SCIENTIFIC AMERICAN, for detecting positive or negative poles in any source? Would the receipt in Query No. 7,484 be all right to use in the tube? A. The solution given in Query 7,484 would work in a tube for a polarity indicator; but the following is better, and is used in all the indicators on the market now: Dissolve 15 grains of phenolphthalein in 1 ounce alcohol. Dissolve 20 grains of sodium sulphate in a pint of water, and add the alcohol solution to this. You will have enough to fill hundreds of tubes. The negative pole turns red with this indicator, and upon shaking up the liquid the color disappears, and the tube may be used indefinitely.

(9590) J. A. R. asks: We hear lately much about the center of the universe. The discussion suggests the following query: Both space and duration are positive conceptions of the human mind, and they necessitate the conception of the infinite, as it is impossible to conceive of either as terminable in any direction. Therefore, if space has no boundary or circumference, has it any center? Place a world at any point in space, it is evidently equidistant from the circumference. Now move it in any direction as great a distance as you please, and if our first postulate is true, it is still in the center of space, for it is no nearer or further from the circumference than when it started. We have, then, the curious paradox of a moving body unable to get away from the center, or if it moves at all, carrying the center with it. Now in regard to duration of time, it is impossible to conceive of any beginning or any end. Therefore, place a man at any point in time, he will never be any further from the beginning or any nearer the end. Is there anything in time, then, but one everlasting and eternal center which we denominate "now," and so far as the human mind can conceive will be everlasting; and if our conceptions are true, neither was ever created, and both duration and space would continue were the visible universe blotted out. Omnipotence itself could not make it otherwise. Now, again, some astronomers tell us the number of worlds are infinite. Philosophers tell us the worlds are made up of "atoms," and that these alone are unchangeable, eternal, indestructible, and infinite in number. Let us assume a world to be made up of 1,000,000 atoms. If both these speculations are true, we evidently have a greater and a lesser infinity. Will some mathematician explain the paradox? A. As we understand the matter, mathematicians recognize that one infinity may not be of the same order as another, and astronomers are doubting if the universe is boundless in extent. It is certain that the old idea of universes upon universes in celestial spaces with nebulæ surrounding all is no longer held.

(9591) F. A. McC. asks: Is there a method by which any angle can be trisected? If not, is there any prize for the person who successfully trisects one by geometrical constructions, and proves the operation to be correct? What is meant by "squaring the circle"? A. There is no method by which every possible angle may be trisected, but there are plenty of methods by which some angles may be trisected. Indeed, the number of angles which may

be trisected is quite large. There is no prize to be won for trisecting angles. The matter is well understood by mathematicians, and no longer excites interest even. To "square the circle" one must find the side of a square which has the same area as a given circle. This it is impossible to find. The area of a circle is 3.141592 times the square of the radius. As this number can never be found with exactness, the area of a circle and the side of the equivalent square can never be found with exactness. Any desired degree of approximation can be had by carrying the number given above to a greater or lesser number of decimal places. It has been computed to several hundred figures.

(9592) O. C. S. asks: 1. How nearly can astronomers tell the exact time? A. Time may be determined with ease to the hundredth of a second, and very closely to the thousandth of a second. The position of stars and the bodies of the solar system may be known to the same exactness. 2. How nearly can they tell the time of a coming eclipse? A week ahead? A month ahead? A year ahead? Ten years ahead? A. Eclipses are calculated to any desired time ahead. They occur with regularity in a cycle of 18 years 11 1-3 days. Hence it is a simple matter to determine the return of any particular eclipse. The tables are given in the nautical almanacs for each year. These books appear several years in advance. 3. Why is it that jewelers' clocks vary so much, even when regulated hourly by electricity transmitted over the telegraph wires? Are all the W. U. T. clocks of any given city set from the same source, and if so why do they vary two or three minutes? A. Clocks which are intended to be kept together will keep together if properly cared for. If any clocks which you know do not do so, it is because somebody does not do his work properly.

(9593) K. A. says: Is there any process by which a piece of ordinary glassware can be heated until malleable without breaking or chipping the body of the article? Is the process expensive, or does it require a special quality of glass, more expensive than ordinary glass? A. Probably any piece of glass can be heated to its melting point without cracking if the heat is applied slowly enough, and broadly enough to heat all portions equally. It is an unequal temperature at different points of the glass which causes cracking by heat. If this is avoided, there is no reason why any kind of glass may not be heated to any degree without breaking. The kind of glass has nothing to do with the matter. The glass must also be cooled very slowly, or it will be very brittle after cooling.

(9594) G. A. H. asks: Would you kindly inform me through your Notes and Queries the following things with regard to the earth: 1. Assuming that the earth's polar radius is thirteen miles shorter than its equatorial radius, the depression for each mile that you go north is approximately ten feet. Why is it not necessary to make allowance for this in running levels? 2. It is stated that the Mississippi flows up hill on account of the centrifugal force of the earth. There are probably places where it does not descend ten feet a mile, but are there any places where it is below sea-level? 3. Is not sea level at the poles about thirteen miles nearer the center of the earth than it is at the equator? A. Sea level is the level of still water on the earth. It takes into consideration all the conditions of the case as to centrifugal force, and any other disturbing cause whatever. This being the definition of a level, it follows that there are no rivers of the earth which run "up hill," as is so often stated in popular periodicals. In surveying for any extensive work, it is necessary to take account of the departure of the surface of the earth from an optical level or plane surface. It is always done in surveying for water works and the like, else the water would not follow the ways laid out for it. It is not true that the earth curves from a level ten feet in any one mile, as you calculate it to do. The curvature is 8 inches for one mile and 32 inches for two miles. It is true, however, that the surface of the earth is 13 miles nearer the center of the earth at the poles than it is at the equator.

(9595) H. B. asks: Can you tell me through your queries and answers column in the Scientific American where I can find directions for the construction of a small voltmeter and also a small ammeter? A. You will find in the Scientific American Supplement No. 1215, price 10 cents, full plans and working description for making a voltmeter and amperemeter.

(9596) A. G. L. asks: Where will I find description and diagrams of an ordinary stock ticker? Where will I find full description and diagrams of a modern telephone switchboard? A. You will find good descriptions of several of the best stock tickers in Maver's "American Telegraphy," which we can send you for $5 by mail. Also the diagrams of telephone switchboards in Miller's "American Telephone Practice," which we can furnish you for $3 by mail.

(9597) J. G. D. asks: 1. How much and what size wire will be required for a generator to ring through 50,000 ohms? How much for the bell? A. The generator for ringing through 50,000 ohms will require 1,200 to 1,500 ohms of No. 36 B. & S. silk-covered magnet wire, and the bell will require about 1,000 ohms of No. 30 wire. 2. Could you refer me to an electrical book on dynamo design with formula for designing machines? The formula to be easy to work out by a person of average intelligence. Also a book with resistance of all sizes of wire. A. The fullest and plainest book on dynamo design is Wiener's, which we can send you for $3. Swoope's "Elementary Lessons in Electricity," price $2, contains a wire table giving all the usual data for all sizes of wire.

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No large cash down payment is required to secure these shares, as they are paid for in small monthly installments, as the work of development progresses. For $20, as the first monthly payment, you can secure five shares. Then you pay $20 a month for 23 more months, then $10 a month for a limited period, until you have paid $1,500, the full price for five shares ($300 each in the present series). But, meantime, you will have received dividends amounting to $1,050, or $210 per share, so that the actual net cost of the five shares in this remarkably safe and profitable investment will be only $450 of your own money, or $90 per share. Then, from the maturity period onward, your five shares, or acres, will yield you or your heirs $1,200 a year for more years than you can possibly live.

Early dividends are provided by "tapping to death" 400 of the 600 trees we originally plant to each acre, and the 200 trees remaining for permanent yield will produce every year at least two pounds of rubber each, at a net profit of 60 cents a pound. These statistics are vouched for by the Government reports of the United States and Great Britain—the most reliable sources of information in the world.

This means, on your five-share investment, a permanent and certain income of $1,200 a year, or $2,400 a year on 10 shares. Or, better still, 25 shares will yield you $6,000 a year. A single share can be secured on the same advantageous basis.

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We can prove to you that the five shares in this investment, paid for in small monthly installments, will bring you **an average return of twenty-five per cent on your money during the period of payment,** and will then bring you **$100 a month for more than a lifetime**. This opens the door for yourself, not to wealth, but to what is better, a competency for future years, when perhaps you will not be able to earn it. Payments of $4.00 per month the first two years and smaller payments thereafter will secure you one share.

Our literature explains our plan fully and concisely, and proves every statement. We will **hurry it to you immediately** on request, thus assuring you a possibility of securing shares before it is too late. This is absolutely the last call. The large demand for Mutual Rubber shares has made this final announcement necessary.

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NEW BOOKS, ETC.

Decennial Publications of the University of Chicago. Studies in General Physiology. By Jacques Loeb. 2 Vols. Chicago: The University of Chicago Press, 1905. Octavo, pp. 782.

In these two splendidly printed volumes, Prof. Loeb has collected his numerous papers on General Physiology—a subject with which his name has been intimately associated for many years. Particularly noteworthy in this collection is the proof of Prof. Loeb's theory that the heliotropism of animals is identical with that of plants, that, in other words, a moth flies to a flame for the same reason that a plant turns its leaves to the rays of the sun. Other subjects that find a place in the volumes are "Instinct and Will in Animals," "Physiological Effects of Lack of Oxygen," "Experiments on Cleavage," "The Development of Fish Embryos with Suppressed Circulation," "The Influence of Light on the Development of Organs in Animals," "Experiments on Artificial Parthenogenesis."

Modern Electricity. A Practical Working Encyclopedia. A Manual of Theories, Principles, and Applications. By James Henry, M.E., and Karel J. Hora, M.Sc. Chicago: Laird & Lee, 1904. 16mo.; pp. 355; 150 illustrations. Price, cloth, $1; leather, $1.50.

There is always room for a practical, simple, and comprehensive treatise upon the applications of electricity to its manifold forms of modern usage. One of the essentials of such a book should be clarity of statement and practicality of text and illustrations. The book before us combines these essentials in marked degree. The student is taken by easy progressive steps through the various chapters, from the standpoint of the beginner to that of the accomplished and advanced electrician. The entire field of electrical engineering is covered, and the whole has been most carefully edited and arranged, with a view to furnishing electricians and mechanics with a thoroughly reliable book of convenient size at a moderate price.

Elements of Plane Surveying. (Including Leveling.) By Samuel Marx Barton, Ph.D. Boston: D. C. Heath & Co., 1904. 8vo.; pp. 255. Price, $1.50.

This work is so arranged that it will be useful as well to a teacher of but little practical experience and to a student who is studying the subject of surveying privately. Many questions that are apt to confuse a student are carefully dealt with, and clearly explained. The author has had experience both in the classroom and in the field, and is, therefore, able to recognize and explain those parts which are troublesome to beginners. The following points are especially dealt with: Careful description of the instruments; explicit directions for making a resurvey in accordance with different data to be had; discussion on the declination of the needle; simple methods of obtaining a true meridian line; suggestive forms for field notes; and many illustrative examples, together with a clear and complete set of tables.

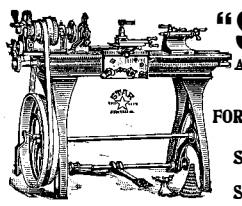
Electricity in Everyday Life. By Edwin J. Houston, Ph.D. New York: P. F. Collier & Son, 1905. Three volumes; 12mo.; pp. 1,750.

The title is well chosen. Electricity has come to be such a common part of everyday life that no one can afford to be without some knowledge of the subject. Electro-technical phraseology is used in the daily newspapers. We come across electricity in a hundred-and-one different ways. Newspapers are printed by electricity; telephone, telegraph, automobiles, cars, lights, etc., are electrically operated; in fact, wherever we turn, we find electricity largely used. It is to supply the non-technical man with information upon electricity that this work is written. Very practical explanations are given of all electrical apparatus in daily use, and no man can consider himself well informed without such a knowledge of electricity in this "the electrical age."

The Organization of Corporations. By Thomas Conyngton, of the New York Bar. New York: The Ronald Press Company, 1904. 8vo.; pp. 352. Buckram binding, net, $2.50; prepaid, $2.70; sheep binding, net, $3; prepaid, $3.20.

This book, which discusses some of the many questions which are considered at the time of the organization and incorporation of every company, is by the author of "Corporation Management," and it is published as a companion volume.

The author states that in writing the book it was his intention to place in convenient form before the reader a manual of reference, which would assist him in refreshing his memory or be of service in obtaining an elementary



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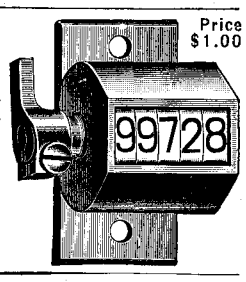

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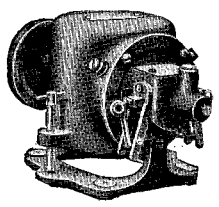

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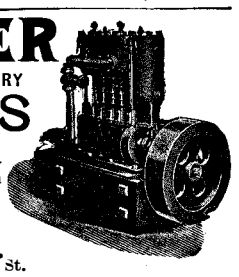

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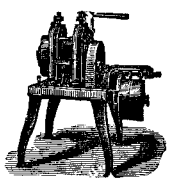

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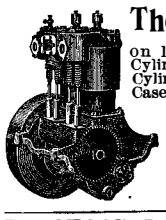

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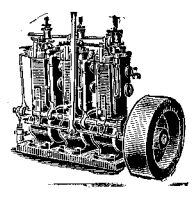

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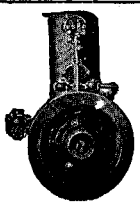

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knowledge of the law and of the practice usually followed in incorporating companies. The book is by no means a comprehensive work on the subject of corporation organization, but it does contain chapters on the principal subjects which are of interest to the incorporators of companies, and as the chapters are concise and logical, the book, as a manual, should, in its own field of usefulness, although perhaps a limited one, be of service to the busy lawyer. The author has in many places made suggestions for the protection of different interests; a chapter being devoted to the protection of minority interests, and another to the protection of inventors at the time of the assignment of their patents to the corporation.

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE

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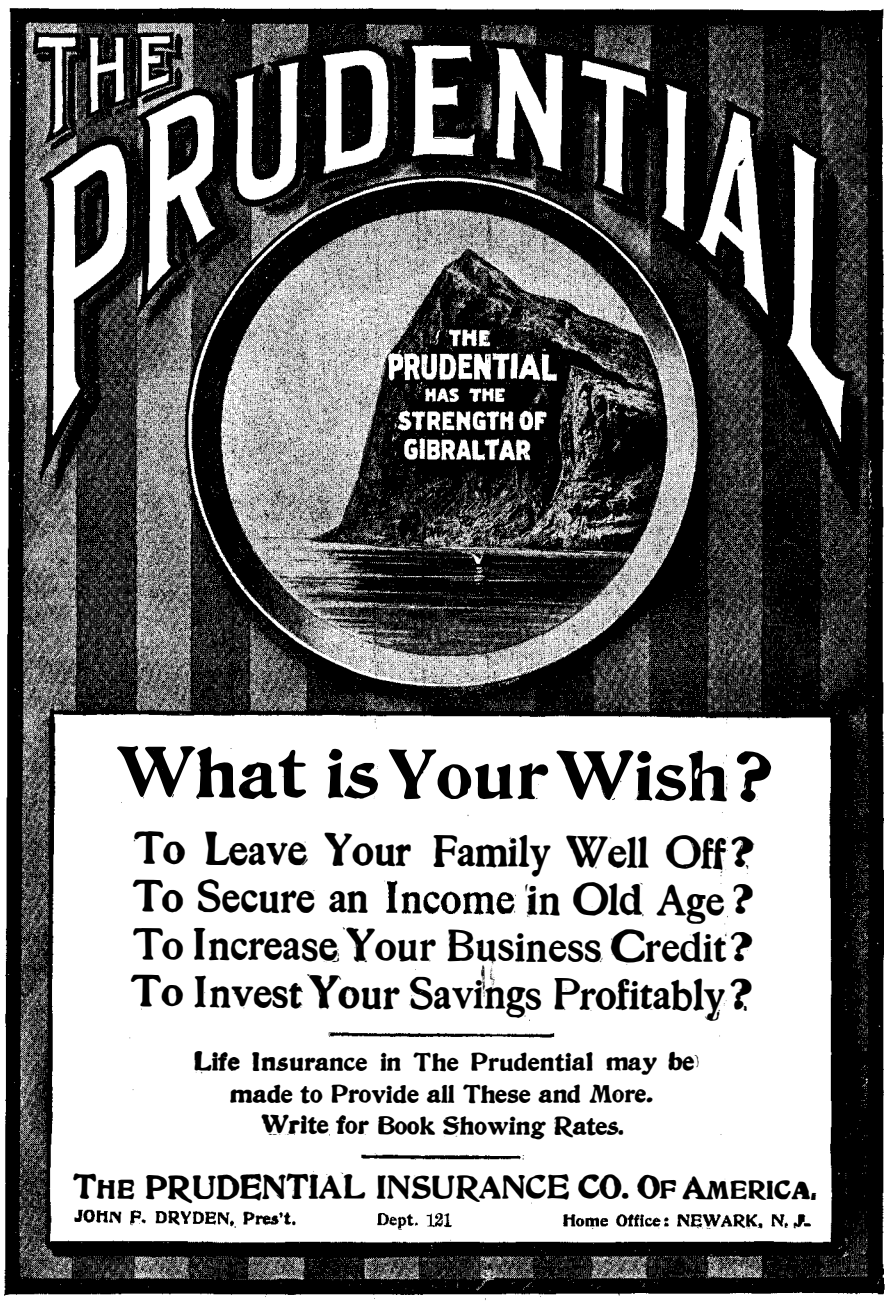
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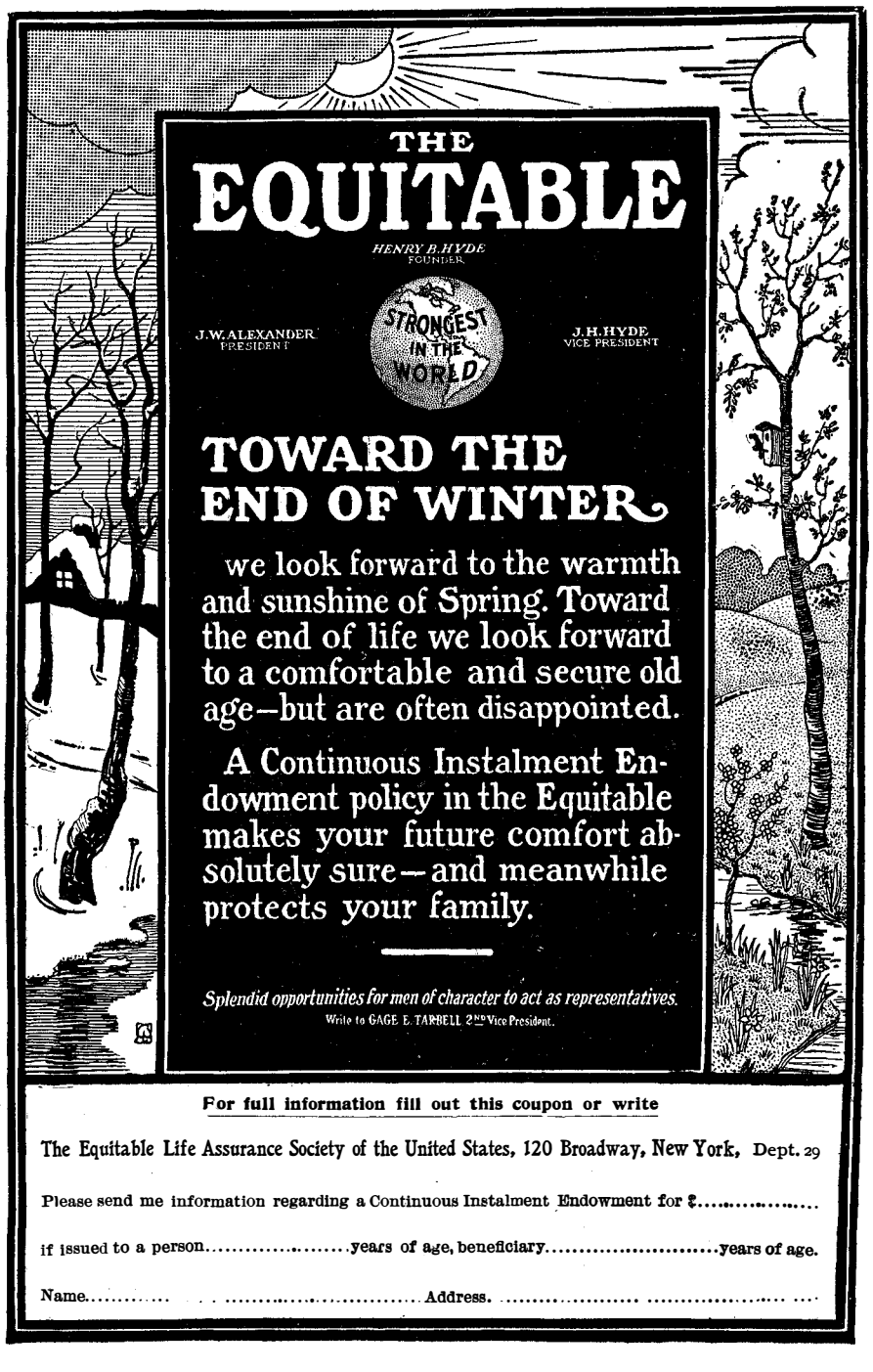
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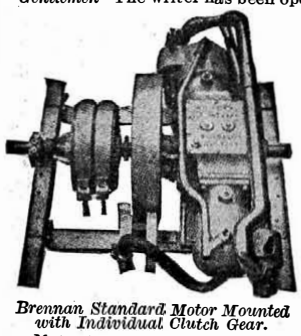
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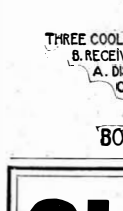

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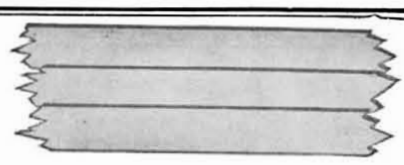
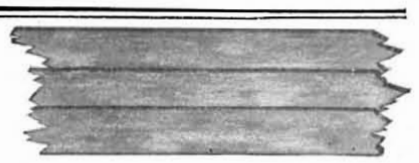

The Paint is Dead when the Oil is gone.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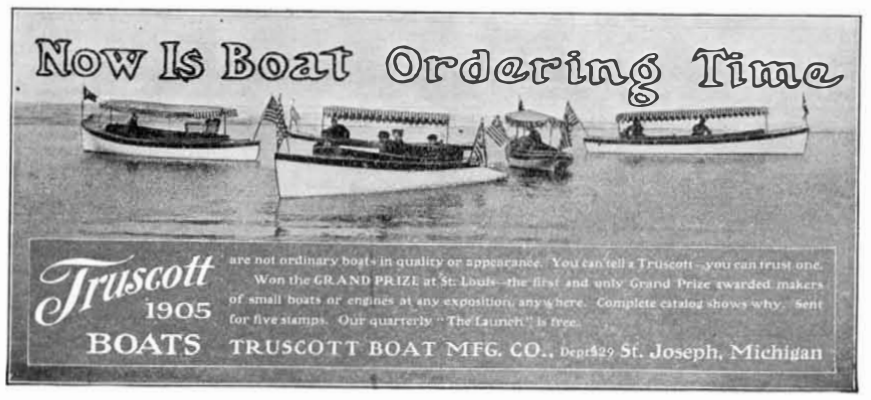
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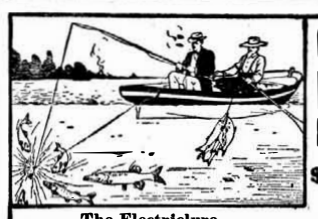
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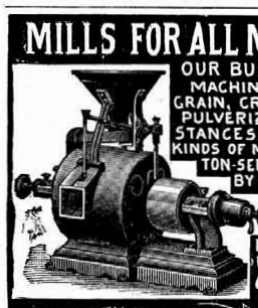

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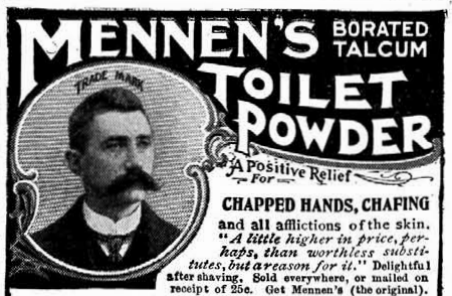

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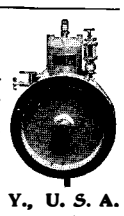

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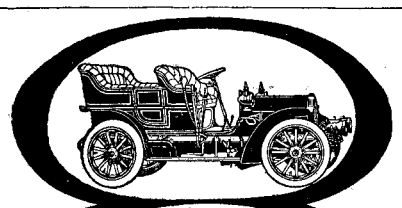

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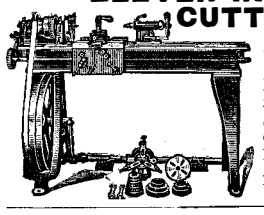

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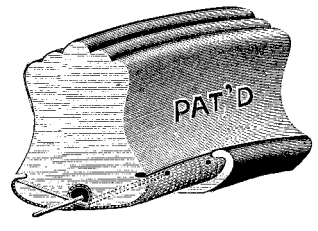

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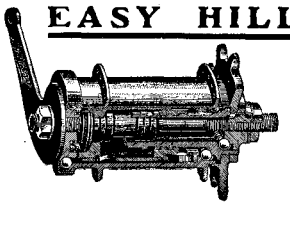

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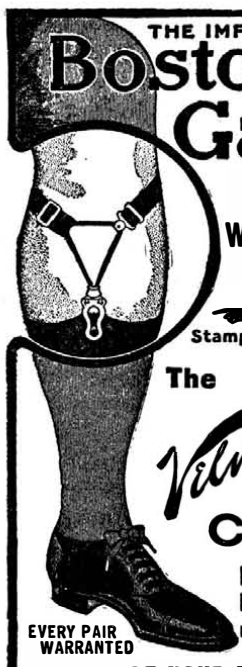

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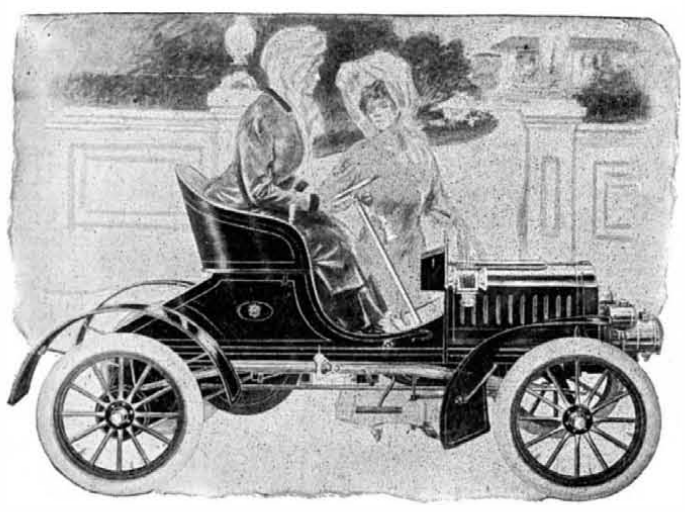

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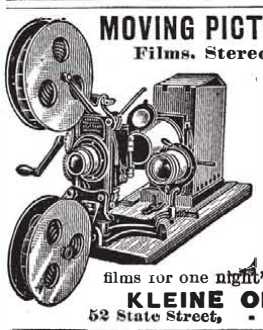

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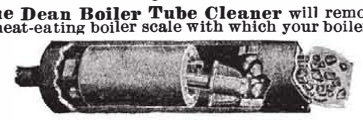

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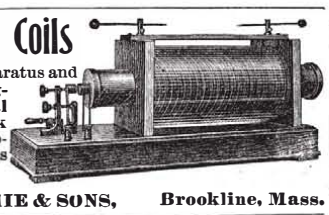

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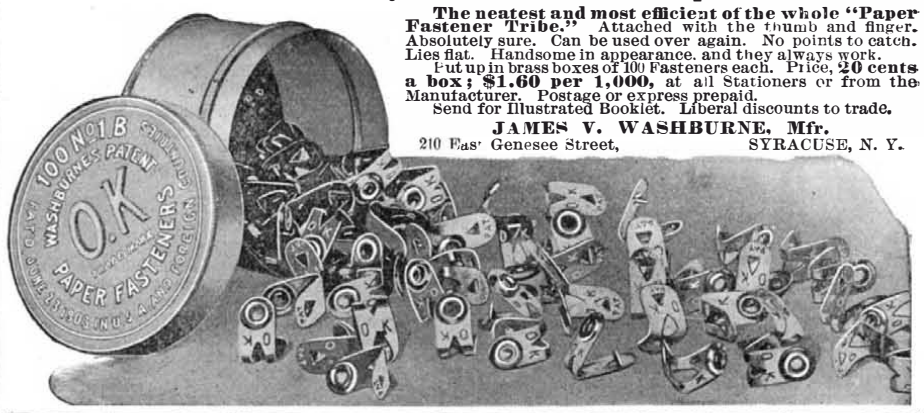

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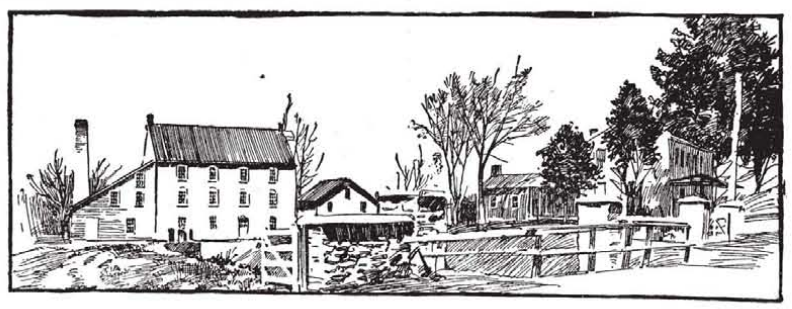

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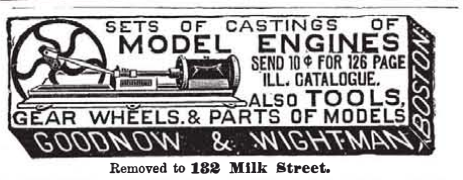

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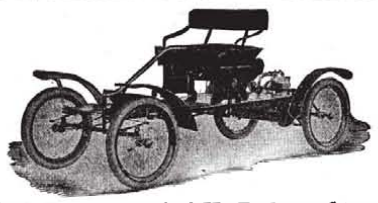

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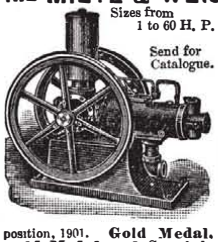

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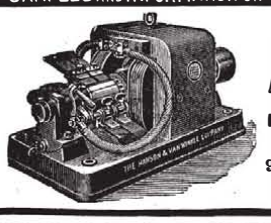

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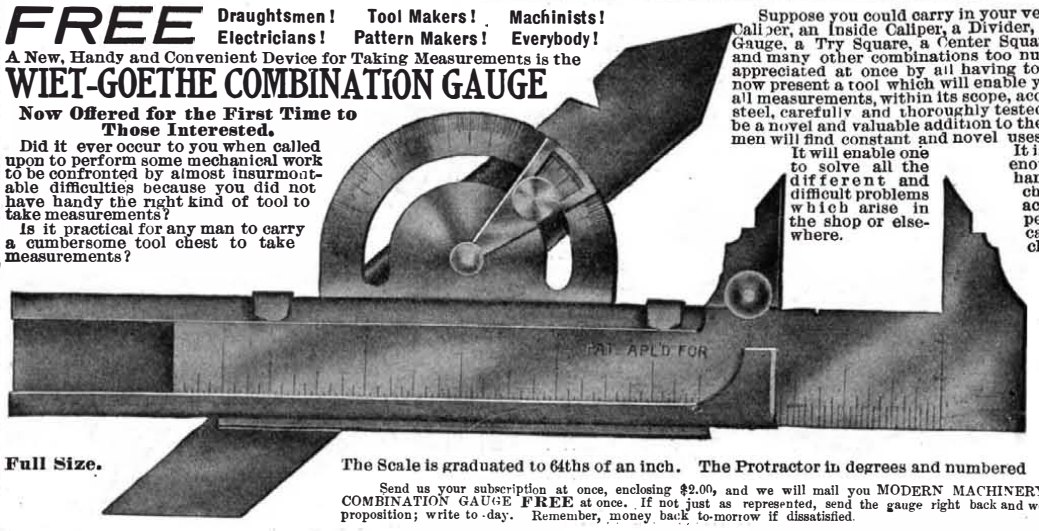

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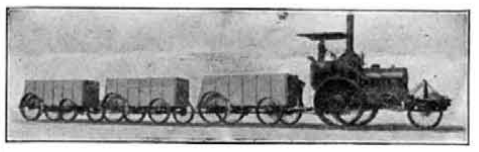

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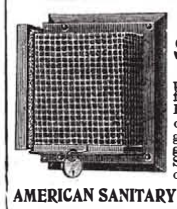

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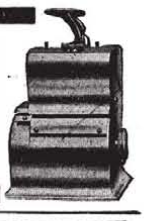

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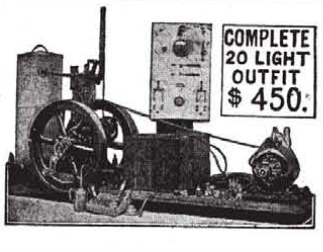

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